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MARCH, 1952

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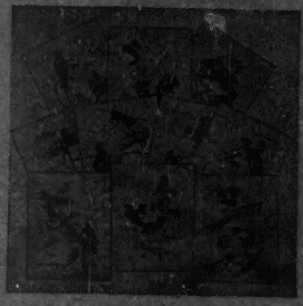

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TWO TRUNKS

The picture of this odd oak was sent to us by W. W. Sigerfoos of Elkhart, Indiana. The two trunks are perfectly joined together to support a single top, and provide a sturdy prop in case of storm. The tree is about three miles west of Burlington, Michigan. How the two trunks became joined is, of course, not surely known, maybe being done by Nature, or by human hands when the trees were young.

Mineralogy

The System of Mineralogy of James Dwight Dana and Edward Salisbury Dana. Volume II. Seventh Edition, entirely rewritten and greatly enlarged by Charles Palache, the late Harry Berman and Clifford Frondel. New York. 1951. John Wiley and Sons. 1124 pages. $15.00.

This book, of course, needs no introduction to the field of mineralogy. This new edition covers halides, nitrates, borates, carbonates, sulfates, phosphates, arsenates, tungstates, molybates, etc. It is the standard text wherever mineralogy is studied, and the revision brings it completely up to date in the field.

Wet Laboratories

This is the title of the Fall, 1951, Cornell Rural School Leaflet, carrying on a series that has thus far included "Outdoor Laboratories," "Lawn Laboratories," "Paved-Desert Laboratories," "Window Laboratories," "Wooded Laboratories," and will be carried on with such as sky laboratories and indoor laboratories. The objective of this series is to show that one does not need to travel far to find myriad things of interest and Nature significance. One can learn about a watershed, the work of moving water, what happens to standing water, pollution and many other subjects right around home.

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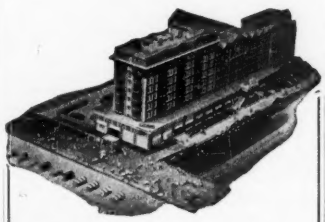
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THE MILWAUKEE ROAD

Nature in Print

By PAUL H. OEHSER

ON THIS "brief December day," as I begin reading Edwin Way Teale's *North with the Spring*, I am riding by train through the Maryland countryside on a little journey from Washington to Philadelphia. When I reach my destination I shall be rushed around the big Quaker City attending to my business. At night I shall return. Here, although traveling more than a mile a minute, is a pleasant interlude. It is a fine thing to have this companionable book along with me. I read in it awhile and muse. It is a leisurely book, and so I can be leisurely with it. "Bare trees imprinted the black lace of their twigs on a gray and somber sky," I read in the very first sentence. I look out the train window and am a little startled, for that describes exactly the scene flowing past me. Spring indeed seems a long ways off. The soiled remains of a recent snowstorm are utterly cheerless. The rivers and creeks we cross are black and cold and foreboding. Lo, the winter is firm;

The cold of its anger crawls in
On the earth like a worm
And burrows where summer
has been.

"At such a time," I continue reading, "when you look with dread upon the winter weeks that lie before you, have you ever dreamed . . . of leaving winter behind, of meeting spring under far-southern skies, of following its triumphal pilgrimage up the map with flowers all the way, with singing birds and soft air, green grass and trees newclothed, of coming north with the spring?" There is no need to answer such a query.

Well, the Teales (Edwin and Nellie) did more than dream the dream. They made it come true. Many years ago Florence Merriam Bailey titled one of her *Condor* articles "Meeting Spring Half Way." The Teales did better than that. They met spring *all* the way, and traveled 17,000 miles to do it. In their black Buick they left their home on Long Island on Valentine's Day, traveled south as far as they could to the Everglades of Florida, and then started back on their three-months' northward trip, which ended the following mid-June at the edge of Canada. In 23 States they saw "the defeat of winter, the homecoming of the birds, the return of the wildflowers." They saw spring come to "dunes and tarns and seashell islands, to caves and underground rivers, to estuaries and savannas," to swamps and mountains. All along the way they listened to the voices of "ever-returning spring". . .

Now vibrations come forth
That seem like the bursting of words
As they spread to the north—
The sound of the singing of birds.

They inhaled spring's "exciting and unfathomable" smells. Spring, characteristically, was always a little ahead of them: they followed in its wake, privileged to participate in some of the rites, *les sacres du printemps*. . .

Lo, the winter is past,
The long winter gone with its sound
And its fury and blast
And spring leaps up from the ground.

One of the principal appeals of *North with the Spring*, it seems to me, is the way Mr. Teale has used the season as a springboard to jump into matters that absorb him as a naturalist, and of which he knows a great deal. Spring is the thread of his book, not the whole cloth. Like the black Buick, spring is the vehicle that carries him and Nellie along the Nature trail. Also, he knows well that Nature is an old, old trail. Think of all that has been written in English alone. Think of the thousands of biologists, professional and amateur, who year after year are probing for the answers . . . all over the world all the time. Still Nature eludes us all; the farther we probe the more wonderful and mysterious and secretive she becomes. As each new answer is discovered, more unknowns open up before us. Yet, the naturalist never quite believes there is nothing new under the sun; at least he realizes that there is plenty he does not know. Devotedly, he keeps on searching, and occasionally the quest pays off.

As the record of the Teales' journey progresses, page after page of Nature lore unfolds — stories of diamondback rattlers in Florida, the eagles of the Kissimmee Prairie, the Cross Creek country of Marjorie Kinnan Rawlings, the floating islands of Orange Lake, the underground river of Nickajack Cave in Tennessee, the poisoned hills of Ducktown, a hundred miles of warblers in North Carolina, the mountain meadows of the Great Smokies, the birds that migrate vertically instead of horizontally, the herb woman of Kite Hollow, N. C., the eels and the return of the elvers, the wonderful pitcherplants, the Dismal Swamp of Virginia, May at Monticello, New Jersey's pine Barrens, a day afield with John Kieran, New Hampshire timberline, and many, many, more.

The unknowns, too, are ever present to keep us humble. On Bull's Island, a part of the Cape Romain National Wildlife Refuge in South Carolina, Teale notes that "there are no foxes because there are no marsh rabbits. Why are there no marsh rabbits? I do not know." . . . "Where the stream that flows through Nickajack originates, nobody knows." . . . "White-throated sparrows, banded at Thomasville, Georgia, have returned in successive winters to the same identical garden, revealing that southward migrants also may have specific goals. But what of the vast spaces between? Do the birds tend to come down at regular stopping places, at what stations along the route?" . . . "Why do birds associated with water so often teeter? Nobody knows exactly." . . . "While the Florida mockingbird raced our machine the farthest, other birds frequently dashed down the roadside to shoot, in a narrow miss, before the car. They seemed attracted to a speeding automobile as a moth is drawn to a candle flame. Why? Why didn't they turn aside or wait until the machine had passed?"

The amazing richness of *North with the Spring* is not easily imparted in a brief review. The secret, I believe, is compounded of the author's varied abilities and wide interests, his knowledge of literature, and his knack of bringing all these to play at the proper moment. Neither is he one to leave himself out of the story, by that passive-voice pose that some naturalists assume when they come to write. People are an indispensable part of Teale's account, and he as an individual plays an important role. We are as much interested in the success of the Teales' journey and in their getting safely home again as we are in the monarch butterflies, the red-winged blackbirds, the skunk-cabbage, the winds of Cape Cod, and the other "characters" to whom we are introduced.

As every young man knows, spring is a subject easily gushed

Mindful of Easter

By GERTRUDE SHISLER GREENWOOD

Though lately here the dogwood burned deep red
Like votive candles in their ruby glass,
Little gray ghosts are they this cloud-draped day,
Their clustered berries withered, dry, and bled
Of brightness. They await the first flute note
Of joyous Easter song from spring's green throat.

Then will this frail tree flower, showing first
Petals like cream with finger prints of rust,
And centered with a crownlet of green-gold.
Later each blossom dazzling white — a burst
Of glory lighting wood or open space
With beauty blinding as an angel's face.

over. *North with the Spring* is not a book of lush sentimentality and shows that it is possible to feel strongly about such an emotional matter as spring without being perpetually in a state of ecstasy.

Teale is a level-headed naturalist and scientist. We are fortunate that he can write with artful restraint. To complete a signature the publishers have concluded this book with an 8-page "anthology" of extracts from reviews of Teale's previous volumes. I was surprised to find myself quoted (from a review of his *Days Without Time* in the *Scientific Monthly*), but I was not surprised at what I had said. It is still true: "Those who follow the genre of literature we call nature-writing are coming to regard a new book by Edwin Way Teale as an event. First of all, he is a good writer; he has something fresh to say about nature and says it directly, simply, and authoritatively; he can be learned without being pedantic, and dramatic without being sensational. Second, he is a good photographer."

The excellent illustrations in *North with the Spring* demonstrate again Teale's mastery of the photographic art. The pictures are well and unstintingly reproduced by halftone. Teale's photography, it appears to me, is a happy byproduct of his remarkable powers of observation. These observations, many of them subtle and original, are the meat of all his books. Either with the human eye or with the camera, it is not an easy thing to observe Nature accurately and freshly. It takes an awareness and an affinity that are well-nigh miraculous. Teale can do it. "As Nellie and I drove on," he writes, at the end of the chapter on their visit to the Louisiana lowlands, "we talked of how few are the men, in all the written history of the world, who have known a fellow feeling for creatures called wild. The story of St. Francis of Assisi needs no miracles to make it superlative. It is a miracle enough to find a man well disposed toward all living things around him."

North with the Spring: A Naturalist's Record of a 17,000-mile Journey with the North-American Spring. By Edwin Way Teale. New York: Dodd, Mead & Co. 1951. xviii + 366 pp. (5½ by 8⅜ in.), with 32 pages of photographs by the author, end-paper map of the route by J. MacDonald, index, and excerpts from reviews of Teale's previous books. $5.

Garden Book

America's Garden Book. By Louise Bush-Brown. New York. 1952. Charles Scribner's Sons. 1242 pages. Illustrated. $4.50.

This is a new and revised edition of this guide to gardening, plant culture, lawn care and planting of trees and shrubs. The first edition appeared in 1939 and the new edition takes into account progress in horticultural practice during the past dozen years.

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Big Bend Plants

Plants of Big Bend National Park. By W. B. McDougall and Omer E. Sperry. Washington, D. C. 1951. U.S. Government Printing Office. 209 pages. Illustrated. $1.00.

In his notable article on Big Bend National Park in the January, 1950, issue of *Nature Magazine*, Victor H. Cahalane reported that this book was in process of preparation. It has now found its way into type and it will add greatly to any visit to this great park. Big Bend boasts an interesting and varied flora and this is one of the outstanding attractions of the park. In preparing their text the authors endeavored to avoid too technical treatment in order that the book may be useful to more than just those with considerable botanical background. There is a profusion of illustration and the identification keys are readily usable. The National Parks Service is quite proud of this book, and with reason.

The Shell Book

The Shell Book. By Julia Ellen Rogers. Revised edition. Boston. 1951. Charles T. Branford Co. 503 pages. Illustrated. $6.50.

The earlier edition of this standard guide to mollusks has long been out of print and available only through dealers in second-hand books. Those interested in the collection and identification of shells are therefore indebted to the publishers for this revised edition, which contains many new shell names. Of the new edition Dr. Paul Bartsch, Curator-Emeritus of Mollusks of the Smithsonian Institution, says, "*The Shell Book* is as fresh and stimulating today as when it was first written." The revision has been done by Dr. Bartsch's successor, Dr. Harald A. Rehder, but he has left the basic text the same. There are 67 shells pictured in full color and there are 412 black and white photographs.

Adventure in Nepal

Search for the Spiny Babbler. By S. Dillon Ripley. Boston. 1951. Houghton Mifflin Company. 301 pages. With end maps of Nepal and other illustration. $4.00.

Here is a book of adventure in one of the world's last lands of mystery, Nepal, where few Americans or Europeans have penetrated. It is, also, a paradise for the naturalist and a challenge. The author and fellow ornithologists accepted the challenge, traveling eight thousand miles to the capital. This is the story of the trip, fascinating to anyone interested in Nature, in birds, or in exploration. The author is Assistant Professor of Zoology and Associate Curator of the Peabody Museum of Natural History at Yale. He is an outstanding bird student and a facile writer. He found the spiny babbler and he found also many other birds, and much adventure.

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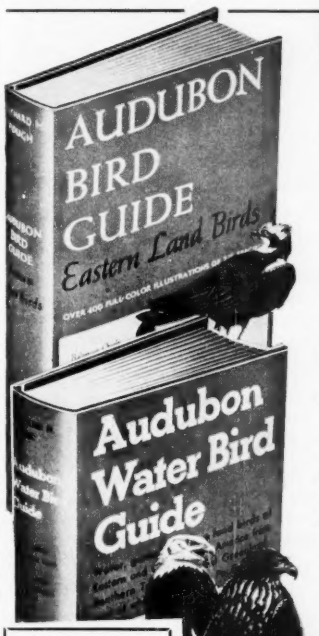

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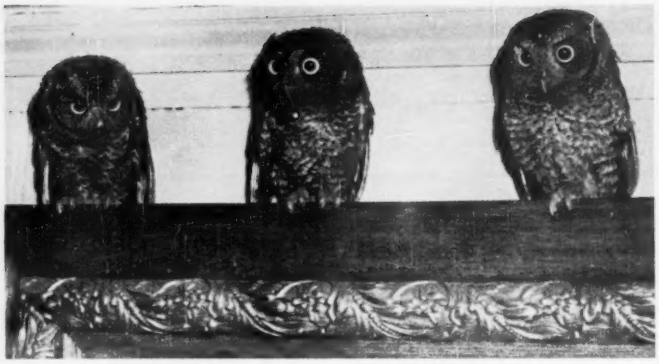


THE "BOYS"

By Elinor Mehmel

In May a gale blew three young screech owls from a tree, leaving them helpless and hungry, and us with three house guests. We stared at them and they stared back through yellow, saucer-round eyes, meanwhile clacking at us with a noise like that made by "store" teeth. Recalling a *Nature Magazine* article by Mary Travis Arny about raising an orphaned owl, we hunted this up and briefed ourselves quickly. We named the trio "The Boys" despite a complete lack of knowledge of their sex, and christened them Peter, Paul and Pat.

After a few days of having hamburger stuffed between their bills, the owls got onto he idea of picking food up in their claws and feeding themselves. They disdained dog food of any kind, so we bought them the cheaper offerings of the local meat market — kidney, pork liver and chicken hearts. Dead birds, squirrel, rabbit and fish were offered, when such were available, and eaten with relish.

Caged at first, the "Boys" were given the freedom of a shed so that they could fly about and strengthen their wings in anticipation of liberation. Of course we became much attached to them but felt that they should be released before they became too dependent. So, one evening, we reluctantly said our goodbyes. Dawn found them perched in a neat row on their pet shelf in the shed, scolding us for not providing breakfast. Succeeding days were spent in the shed, or among the old rafters in the barn. Each evening at dusk the owls would swoop in and demand a handout.

Peter, our favorite, was an extrovert and leader of the trio. He liked to have his head scratched. Paul was often cantankerous, and Pat was painfully shy. The evening visits continued for seven or eight weeks after release, then ceased. A neighbor's cat got Peter, but once in a while we can hear Paul and Pat calling in the darkness.

THE GREATEST MORAL ISSUE

By Dan Saults

Editor, Missouri Conservationist

(Reprinted from Missouri Conservationist for November, 1951.

Dictionaries use a considerable amount of space in defining morals but it might be boiled down to an ancient fundamental issue: knowing right from wrong.

Defining right and wrong, good and bad, virtue and vice is difficult; there are ever the shadings that spread a wide band between the narrow black line of utter evil and the equally thin margin of pristine purity. But to achieve simplification here, also, it seems logical to argue that actions which injure the race of man and threaten the future of the species are, in their very nature, immoral. If it be wrong to injure the individual, to hamper him in his pursuit of personal wellbeing, then it is a greater evil to sin against all mankind.

The destroyer of natural resources — be he game hog, forest vandal or huge exploiting corporation — has committed the greatest of all wrongs; he has posed a direct threat to mankind's future. He has, for personal and immediate gain, robbed those who will come after him and impoverished the unborn of a nation, a continent and a world.

Can these moral implications be challenged? Laws of the body politic are made by men, and men are liable to error; it is only by general agreement and the power of police that such statutes are obeyed. But the great natural laws are implacable and irrevocable; they are enforced by the enormous sweep of time and the sentence is recorded with a bloody pen in the pages of history. There can be no appeal from the surging flood sweeping down from stripped hillsides; there is no mercy in the judgment rendered by the marching desert. The moral decay of the Roman Empire had deeper roots than bread and circuses; and the glory that was Greece became a memory as the forests disappeared from the steep mountainsides of that peninsula.

The role of the lamenting prophet is not an enviable part to play — but the thoughtful human must play it if mankind is to be saved from its sins against the natural laws that govern the course of the planets and the hiving of the bees. Someone must break in upon the paeans to prosperity with the bitter chord of a great cry: "Vanity, vanity, all is vanity!"

Beneath Sahara sands are the ruins of once-great cities whose very names are forgotten. Where the Tigris and Euphrates now flood terribly across a desolate land, sterile silt builds up above the temples of vanished civilizations that were going to be eternal. Those beautiful cities, those cultures that carved the great statues half-buried in the sand, sinned against the Master Morality and called down upon themselves the doom of final oblivion.

Not all our science, our research laboratories, our test tubes and burners and atomic explosions, can save us from our sins against ourselves. Our little magic formulas cannot guard us against the day of atonement. We are going to farm the sea, we are going to grow our food in miraculous solutions, we are going to force production from barren soil — and the Greeks were going to conquer fresh territory, the Romans were going to take over new lands, Hitler was merely seeking room to expand — for which read new resources to exploit.

Is this a far cry from fish in the streams, game in the fields and trees on the hillsides, the job with which Missouri's Conservation Commission is charged? Do you think there is no correlation between the dried lakes of Mexico and the drained swamps of southeastern Missouri? Do you know the potential of the soil that muddies our rivers, of the gravel that fills streams where once the bass lurked in deep holes?

We have broken the Master Morality and we are paying the penalty — but there is still time to cease sinning and seek forgiveness.

Will we?

Educational Films

Release of its 1952 Educational Film Listing is announced by Sterling Films, Inc., 316 West 57th Street, New York 19, N.Y. This free catalog includes more than 250 titles of 16mm films with sound and in black and white and color.

Heroines

A Treasury of the World's Great Heroines. By Joanna Strong and Tom B. Leonard. New York. 1951. Hart Publishing Company. 190 pages. Illustrated. $2.50.

This book is written for an audience from ten to fifteen years old and introduces the young readers to American heroines from Pocahontas to Amelia Earhart, and world figures from Queen Esther and Joan of Arc to Hannah Senesh.

Contents Noted

AFTER reading Paul Shepard's article in our January issue, one of our members writes from Tama, Iowa, to say: "I wish you could observe all Iowa counties which are spraying their highways for weed control. In Tama County, where they increase appropriations each year for more and more spraying, the roadsides are dead from tree top down to the paving or gravel. And we are taxed accordingly to do the work each farmer should do. There is no pleasure driving in the rural areas now as all is brown and sere. But the havoc to wildlife for food and cover is appalling. Supervisors will tell you they have worked out a formula which kills only weeds, but in talking with hunters and bird lovers the true story is entirely different." Iowa is not alone so far as the recent passion for attacking the roadsides with powerful weedicides is concerned. Most of these chemicals have questionable selectivity, and their effects on domestic animals and humans, let alone wild animals, is in no small measure undetermined. While the Soil Conservation Service and State conservation departments try to educate the rural citizen to the importance of hedgerows and fencerows as wildlife habitat, another agency goes about destroying the same thing. Strange!

ONE OF the most important pieces of legislation now pending in Congress, from the conservation viewpoint, is H.R.5023. This bill, introduced by Congressman Leroy Johnson of California, would specifically prohibit the construction of dams and reservoirs in any national park or monument. Under the Antiquities Act, which established the national park system, such invasions were banned, but there are loopholes in the law. Through these holes public and private agencies constantly seek to crawl when they see some river they would like to dam for power or irrigation. The proposed invasion of Dinosaur National Monument in Utah is a case in point. It is up to conservationists to get behind the Johnson Bill and get it out of the committee pigeonhole. Hearings and Congressional discussion of this measure would serve to air the whole subject of Corps of Engineers and Bureau of Reclamation designs on these areas. Pressure from Federal agencies, combined with local selfishness that sees benefit from a temporary "boom" during the construction period, serve to require a constant vigilance in protection of the resources of the national park system. These areas, having been set aside for their outstanding character, should not have to be protected, month by month and year by year, by their friends. Areas in the national park system are the property of the American people. It is a travesty that agencies of the government that represent these people should seek to injure the parks. But since they do, the areas should have thrown around them a legal barrier of unquestionable strength. Let us get behind the Johnson Bill.

FROM a member in Lincoln County, Missouri, comes a letter inspired by our comment here on the farmer who discovered the large proportion of lawless gunners in Illinois by setting up a decoy pheasant on his property. Our member's report is worthy of recording, and without much necessity of comment: "I am a widow living on a small plot of forty acres. Since I have been alone for eleven years, there has been no stock or cultivation on the farm. The fencerows have grown up in trees and brush, the open land in grass, briers and weeds. The woodland has many kinds of nut trees, and a number of large old trees with hollows for dens. A small creek, fed by a spring, runs through the place, and there is an old orchard with a pond. It is really an ideal place for wildlife, which I have carefully encouraged. Nearby farms are kept closely "barbered," and there is small chance for wildlife to raise families on them, but my land provides protection and wild food, and is overflowing with wildlife. We have had heavy snow and ice, so my wild friends have come to my yard and windowsills and doorsteps for food. One covey of quail hovered around a big brush pile near the road. One afternoon recently I was at my window watching two squirrels eating nuts I had supplied. A car backed into the lane. Two men got out with loaded guns; one shot one of the squirrels, the other fired into the covey of quail on the ground. By the time I reached the porch to order them to leave they had picked up squirrel and bird. Someone in the car, the engine of which was running, called out to pay no attention to me, using unprintable adjectives. We have laws prohibiting such behavior, but how can we enforce them? Would it not be a good idea to make anyone prove himself a decent citizen before granting him a hunting license?"

MARCH is the month of the annual drive of The American National Red Cross, and eighty-five million dollars has been set as the absolute minimum goal sought, with less than which the Red Cross cannot carry on its great and mounting responsibilities. John S. Sinclair, president of the National Industrial Conference Board, has been named chairman of the 1952 drive. We are always, of course, happy to provide free advertising space to the Red Cross at this time. We are also asked to give other publicity to the campaign. It always proves difficult to find something in common between the great work done by the Red Cross and the nature and conservation program of our association and the scope of our magazine. We all have in common, however, a deep concern for man and the humanities, and it always seems scarcely necessary to redescribe the great contributions of the Red Cross, whether in time of disaster, in meeting the tremendous need for blood, or in aiding in strengthening our civil defense organization. You need the Red Cross, and the Red Cross needs you, so when the March appeal is made, answer it generously. —R.W.W.

PHOTOGRAPH ALLAN D. CRUICKSHANK FROM NATIONAL AUDUBON SOCIETY

"In flight the osprey is a creature of breathtaking beauty. Its black and silver-white underparts catch and reflect the glimmer of the waves. Its powerful pinions bear it in graceful, soaring flight above the waters. . ."

When Nancy, the author's own fledgling, decided to climb to investigate the osprey fledgling in the nest, there was some unexpected excitement. Tom Young, Jr., however, got Nancy safely back to solid ground.

Banding Our Ospreys

By MARY ARNY

THE FIRST ospreys I ever saw were at Groton Long Point in Connecticut. They were nesting on a pile, well out in the channel. I wondered how they would ever learn to fly. The tide ripped past their home so fast that a full-grown man was hard put to it to row a skiff against the current. Being only four, I was certain that the young birds would all fall out and drown.

I sat on the old trestle for hours, fishing for crabs and watching the ospreys, determined that when the catastrophe occurred I would call for help. But it never did. The young birds sat on the edge of their nest, beating their wings against the salt breeze, until one day they rose perpendicularly, and, like small helicopters, practised vertical flight. Then, one day, they took off, one at a time, horizontally. The mother bird soared beside them, and when she saw them flagging, dipped under them and bore them up on her own wings.

So it was that the osprey became to me a symbol of the wisdom of the wild folk and something to be respected and admired.

There is no more handsome and respectable bird on the North American continent than *Pandion haliaetus carolinensis*. With its wing-spread of 54 to 72 inches, it almost equals the bald eagle in size. The osprey menu includes snakes, salamanders, frogs, and fishes of little economic importance, such as carp, sunnies, suckers, breams, killies, alewives, horned pouts, and menhaden. Most of this bird's food is taken alive, but it occasionally picks up a dead fish, or one swimming feebly on the surface.

In flight the osprey is a creature of breathtaking beauty. Its black wings and silver-white under parts catch and reflect the glimmer of the waves. Its powerful pinions bear it in graceful soaring flight above the waters, and when some unwary fish catches its eye it folds its wings and comes down in a stoop as swift as an arrow.

The talons of the osprey are deadly in their grip. The outer toes are movable forward and back, as are those of owls. The claws, needle sharp and backed by a rough scaly pad, perform a job of grasping like pincers, and hold the prey in such a firm grip that sometimes the osprey itself can not loose them. I have seen one bird dragged under and drowned by the weight of a fish that it could not release.

The feathers of the osprey are particularly suited to

The author, at the osprey nest, reaches in to get the nearest young bird for banding. The nest was so large, however, that it was impossible for her to reach the farthest bird without climbing into the nest.

life on the bounding main. They are oily and heavy. The thick and full feathers of the head serve to break the impact of the dive. As to the oil, the Indians, who call the bird *Ismaques*, aver that it is a means of attracting fish, and some of them rub their bait in it to this day. That Indians can take fish where a white man has fruitlessly beaten a pool to a froth, is fact. Whether this is due to the magical properties of osprey oil or to a thorough knowledge of trout psychology, I am unprepared to say. Be that as it may, the oil does protect the feathers of the bird, and when it rises from its plunge, in what falconers call a "rouse," shakes itself free of the droplets and flies off, always bearing its prey head first, it is a sight to behold.

The theory has been advanced that the manner in which the osprey carries fish head forward tends to reduce wind resistance. It may well be that, but one wonders if the osprey would not be apt to take the fish from behind and strike for the vital nerve areas near the head. I have never seen an osprey shift or turn its catch after taking it, although they may do so. Long experience in the field has taught many of us the value of silence as to what wild creatures do and do not do. With all due respect to the books, I have seen wilderness creatures do many things that the experts categorically rule out.

There are many ospreys in the world, all of one species. Our subspecies, the American osprey, is found near seas, lakes, rivers and water courses over the entire continent, as far north as the edge of the tundra. It is however, more numerous on the coast than in the interior.

The presence of this bird is proclaimed by its massive nest, built high in a dead tree in the wilderness. In civilization it often builds on telegraph poles, and rarely on the ground or in low shrubs. The shrill "kree-kree-kree" of the osprey is not unlike that of some other hawks, but its steady, almost ringing beat, is unmistakable. The nest that we visited last summer for purposes of banding is more than six feet deep and eight feet in diameter. When I went up to the nest to get the young birds I was unable, even by lying on my tummy on the edge of the aerie and practically swimming in the air, to reach the far bird. In spite of the bulk and strength of the nest, I feared to clamber in lest my one hundred and twenty-five pounds might dislodge it.

Tom Young, senior and junior, came to the rescue, and the latter, with his long reach, got the far bird down. These two gentlemen deserve high praise for their unsung work in behalf of the wildlife of Shelter Island, which lies between Orient Point, the eastern tip of Long Island, and Montauk Point. They have built and guarded scores of platforms on dead trees and staypoles so that the ospreys and the power lines could both survive. They have hand-reared many wild creatures and know the island like the palms of their hands. Mr. Young assures me that the nest that we visited has been in existence and in use for fifty years, and I understand that he has observed one nest that was occupied by what was apparently the same pair of birds for twenty-three successive seasons.

One wonders how a nest could endure through half a century of northeasters and the three known hurricanes in the last decade. It is built of sticks varying from pencil thickness to a good four inches in diameter, and reinforced with brush, rubble, cornstalks, kelp, and even fishnets. Lined with cedar bark, seaweed and leaves, the massive nest structure remains secure, and the birds, wise in the ways of Nature, reinforce it each fall before leaving for their winter quarters in the Gulf States. It is unusual to see the birds after October first, and most of them return to nesting sites in April. It is in these two months that one is most likely to see the repair job in progress. It may be easily watched at Gardiner's Island, where the birds sometimes nest on the ground. This island is off Orient Point, and is the reputed hiding place for Captain Kidd's elusive treasure.

The osprey raises only one brood, usually laying its

eggs in May, although there is an early record for April 18, and a late one for June 12. The eggs are from two to four in number. They vary in color from creamy-white to reddish-brown, mottled and varied in hundreds of patterns. The young birds are sandy-brown, also mottled and strongly resembling pheasant chicks in general aspect. They are exposed to beating rain, wind and broiling sun, but the parent birds often cover the young with seaweed while they are away from the nest, thus assuring protection from the elements.

The osprey has no enemies except the eagle and man. The eagle does not attack the osprey to kill it, only to steal its fish. Man however is a serious threat. He has, for example, extirpated the birds from the British Isles. Captain C. W. R. Knight, described the activities of eggers in an article in *The National Geographic* for August, 1932. One lone nest remained in Inverness, and the ospreys were striving pitifully to rear a family. The nest was in a dead tree on an island, and the base of the tree had been fenced with barbed wire to protect the birds from molestation. Someone, who had more determination than brains, managed to steal the eggs in spite of locked boats, icy water, barbed wire and armed guards.

Captain Knight took four young ospreys, all in fine condition, and all from different nests, back to the British Isles from Gardiner's Island. So far as is known he was not successful in reestablishing the species. There is, of course, a critical point beyond which a species can not diminish and continue its normal breeding and social behavior. An abnormally small population seems to destroy the social and breeding pattern of birds and mammals alike. It is interesting to note, in this connection, that Noah was instructed to take seven of each of the fowls of the air on the famous voyage of the Ark. Whether this indicates a knowledge of the social behavior of birds on the part of the ancients, or implies that the Creator was aware of their foibles, would make a lively subject for a dinner table discussion.

It may be that ospreys know that some men are a potential danger. It is certain that they do not like to be disturbed. It is only on such sites as Gardiner's Island that a reasonably close approach to the adult birds can be made. Here they have been left severely alone because of the lessors' strong feeling in the matter, and because of the difficulty of access to the island.

At Orient Point, twenty years ago, one could have a fine view of the birds, even seeing the red of their eyes. Now that the automobile has made the area easy to get to, it is hard to approach even close enough to get pictures with a telephoto lens. Only excellent work by the wardens has prevented the destruction of this colony. The hordes of people, unschooled in conservation, who are rapidly making our beautiful country into one vast honky-tonk, amuse themselves by throwing beer bottles into the nests. In State parks in New York, however, the police are on the alert, and there, at least, there is hope of protection for the birds. Connecticut has recently passed a model law that protects *all* hawks and owls, and there is hope of a similar law in New Jersey if enough pressure is brought to bear upon the Legislature. New Jersey needs the law as badly as any place we know, for ospreys, as well as anything else that flies, are targets for the gunners in the paths of migration.

Tom Young holds the young osprey, which perches on his hand after the fashion of a tame falcon.

Considering the treatment that most of the hawks get from man I wonder that they are as patient as they are. But at great risk to my ornithological neck, I dare hazard a guess as to most creatures, man included — they know their friends. In hundreds of wildlife encounters, over a lifetime of experience, ranging from bull moose through lynx, timber wolf, owl, hawk and so on, I have never been mauled except by a chickadee. I confess to a precipitate retreat from a grizzly bear with two cubs. Friends of the wild people do not irritate them beyond endurance. One day, no doubt, I shall blunder and get what I richly deserve.

Everybody told me that the ospreys would tear me apart. One man spun a grim yarn of having been knocked off a pole and dashed on the rocks by a blow from the fish hawk talons. I can believe it, and I admit that I was scared. Still, if one is to band a bird, one must go and get it. So up I went. Poison ivy was the greatest hazard. Mrs. Osprey took off, screaming in-

vectives, and as I reached the edge of the nest I felt the rush of air from her wings as she swooped over me. I peeped into the nest and found myself face to face with two pairs of glaring red eyes, owned by two full-fledged ospreys. Heavy gauntlets are not conducive to a good grip, so I stood as still as my shaking knees would permit. I reached in slowly and took the nearest bird. To my complete surprise it perched on my wrist like a tame falcon while I explained to it quietly that I was not going to hurt it, and hoped that it would return the compliment. The bird scowled a little, as though trying to make up its mind whether the truce would be reciprocal, raised its crest, shook its feathers, and decided to accept the situation calmly.

The male osprey came in with a swoop. I could hear the air whistle through his wings, but a quick sidewise glance showed that his talons were not out for a strike, and I slithered down the tree. The female circled and came to rest on a dead tree some twenty feet away. The young bird was banded without incident, except that it is hard to close the large bands straight and one must exercise great care to avoid leaving them so that they can catch in fish nets or chafe the bird's leg. This is a bit time-consuming, and would have been a real problem if the young osprey had been inclined to struggle.

Possibly the sight of our own three small fry reassured the parent birds. Possibly the quiet excellence with which my husband, Bob, manages cameras, pliers and everything else soothed their nerves. It does mine. Nothing was rushed, or noisy, or confused, and the swoops of the great birds were watchful, but definitely not threatening.

I doubt if Mrs. Osprey got any satisfaction out of one small incident, which should not have happened, but did. I was fastening bands, Bob was photographing, and we were both engrossed in the job at hand. Suddenly a small yellow tuft appeared in the telephoto finder. Our baby, Nancy, had decided to investigate the baby osprey. If Mrs. Osprey had a few bad moments, well, so did we. I do not like my baby up at the top of a tree any better than the maternal osprey liked hers on the ground! Tom Young, who was at the nest, looked down and saw our fledgling climber, spoke to her quietly, and soon the two of them were back on the ground.

When we had recovered from that excitement, we took note of the contents of nests around the island. The ospreys had collected a weird assortment. Golf balls, electric light bulbs, rag dolls, dried fish, carved bits of wood, books — these were some items in the collection. Why they pick up this flotsam and jetsam must forever remain a matter of conjecture, as must the cork float, neatly slipped over a branch some sixty feet in the air, which I saw at Orient Point.

Retirement to the shade was advisable after the many climbs, and we took up a vantage point where we could continue to watch the birds. One parent brought a fish to the edge of the nest, presented it to his mate and watched as she tore it into small bits and fed it to the young. The dropped bits were carefully rescued by the grackles and starlings, which nested in the lower reaches of the pile of sticks that constituted the aerie. Their presence gave further proof that ospreys do not attack small birds.

Piping plovers, spotted sandpipers, and terns nest close to the osprey's home and remain undisturbed. Knight tells, however, of a fatal attack on a night heron, which for some reason was anathema to one osprey.

We hope to be able to continue the study of the ospreys and have already mapped out the nest sites of more than one hundred pairs. Since banding is a purely voluntary pastime we can not organize an expedition and do the entire colony at once, but maybe that is just as well. It could be that wholesale interference with the breeding grounds would disorganize the birds, and it would be tragic indeed if, even with the best of intentions, a single nest should be disrupted permanently.

Of course, any banded bird found dead should have the band removed, flattened, taped to cardboard and sent to Bird Banding, Patuxent Wildlife Refuge, Laurel, Md., together with the place of finding, cause of death if known, and species of bird, if known. A live bird should have the band number copied and sent to the same place, but the band should *not* be removed from a live bird.

I know of a crow flying around, who is constantly walking up to people and demanding food. His band has protected him from harm on several occasions, and as he has now gone completely wild his movements are of great interest. Nick turns up all over the place! So you see, sometimes you *do* meet a live banded bird.

A Cardinal Passed

By MABEL C. SATTERTHWAITE

A cardinal flashed across my way;
A bright, swift dart, he came and went
As if by some strong bowman sent;
And yet he brightened all my day.
It's such a happy circumstance
To have a cardinal pass, by chance.

The Cherrystone Juniper

By DONALD CULROSS PEATTIE

PHOTOGRAPH BY JOSEF MUENCH

A twisted cherrystone juniper, *Juniperus monosperma*, against the background of a sandstone pinnacle in the Garden of the Gods in Colorado. Many junipers grow there.

"One evening in the autumn of 1851 a solitary horseman, followed by a pack-mule, was pushing through an arid stretch of country somewhere in central New Mexico. He had lost his way, and was trying to find his way back to the trail . . . The difficulty was that the country in which he found himself was so featureless — or rather, that it was crowded with features, all exactly alike. As far as he could see, on every side, the landscape was heaped up into monotonous red sandhills, not much larger than haycocks, and very much the shape of haycocks . . . Flattened cones, they were, more in the shape of Mexican ovens than haycocks — yes, exactly the shape of Mexican ovens, red as brick-dust, and naked of vegetation except for small juniper trees. And the junipers, too, were the shape of Mexican ovens. Every conical hill was spotted with smaller cones of juniper, a uniform yellowish green, as the hills were a uniform red."

Thus, in the opening pages of *Death Comes for the Archbishop*, does Willa Cather describe the cherrystone juniper's interminable monotony. It is not a dreary repetition, since this is rather a bright tree, and likely to yield from its growth the flashing blue of a pinyon jay, the call of a Gambel quail, the slinking form of a coyote, a handful of mistletoe, an unexpected burro, or an even more unexpected Indian urchin. But reiterant it certainly is — in form, in color, in sunbaked fragrance. Never was it truer of anything than that whey you have seen one such, you have seen them all.

It is hard, if possible at all, to think of another American tree that, unaccompanied by another species, covers so vast an area — uncalculated thousands of acres of the old Spanish country. Again, it may have a single companion, no taller, no more varied, than itself, the pinyon. Together these two come to haunt all our memories of the red hill country of New Mexico. And they are happy memories, full of the high-curved turquoise of her skies, full of sweet aromas, of the startling liquid voice of thrashers, of the spell of the pueblos, their art and their deeply religious, bronze-skinned peoples. He is lost to simplicity who complains of their monotony. What is more monotonous than the streets, the buildings, the gray, damp, low-skied days to which he is apt to return from the country of the juniper? Many a time we would gladly exchange all that to see again the conical spires of this evergreen rising from the ruddy domes of the little hills down Santa Fe way.

The very air of the old town of Santa Fe entices the visitor, transporting him, from the world of speed and noise, to an older and sweeter way of life, where travel is at the burro's pace, where the commonest sounds are the tinkling of the *acequias* that slide and glitter through gardens and streets, the clangor of old bells with much silver in their copper, and the soft commingling of Spanish and Indian tongues. For in place of gasoline fumes, Santa Fe's soft dry air is pervaded by the smell of pinyon smoke, blent with the odor of the *enebro* wood, as the Spanish-speaking people call the juniper — a mingled perfume, sweet as the curling smoke from some church censer.

And you sniff it everywhere, upon the airs, not only in the narrow *calles* of Santa Fe and Taos, but throughout the pueblos of the Southwest and in the long-settled, warm, Spanish-speaking part of Colorado. For the Indians and the Spanish-Americans, even in the towns, cook by wood fires only, in those outdoor bake ovens of

clay that look like old fashioned skeps. For heating, the wood of true pinyon pine is preferred by many people, but juniper is employed in cooking, because of the intensity of its heat and its glowing bed of coals. It has, however, the disadvantage, in an open hearth, of throwing sparks, and is used there chiefly to clean out flues and chimneys, according to Haniel Long, the distinguished author of *Pinyon Country*.

Twenty and thirty years ago, if you went walking in the pinyon- and juniper-clad hills around Santa Fe, you were almost certain to meet the head of a donkey bobbing toward you on the trail; then you saw the big faggot of *enebro* on his back, fixed there on a wooden saddle frame, and behind him paced an old man, or a small boy, carrying a stick for the better correction of the burro's innate sin of sloth. This was Santa Fe's fuel supply; perhaps four dozen crooked sticks of dead and seasoned wood at a time, advancing at the slowest rate that the burro can manage. It followed, therefore, that there had to be more than one old man and donkey, and, indeed, the woods were full of them, all wending their way from the surrounding hills to the little adobe city. It was the same around Taos, and every other town wherever the juniper grows and the Spanish tongue is spoken. The streets, between the adobe walls, especially toward twilight, were filled with the clatter of burdened donkeys. They delivered the wood directly to the householder's gate in the wall, without any middleman to take away the pleasures of the courteous greeting from the vendor, of the buyer's pat on the little burro's flank, a word or two in his cocked ears, and a "Vaya con Dios" as beast and man depart. Today trucks go rattling out on the roads and the wood is delivered without picturesque accompaniments.

The odor of "pinyon smoke" curls its way into the heart. That aroma first became known to Anglo-Saxon Americans in the days of the Santa Fe Trail, the eighteen-forties, when the early traders set forth from the prairie "ports" — Westport and Franklin and Independence — for the then-forbidden pueblo of the Holy Faith, to carry to it Yankee manufactures, and bring back Spanish silver and Spanish mules. They say that those who, like Kit Carson, had once known the bells and the women and the "pinyon smoke" of Taos could never stay away, come Kiowa, come Sioux, come Kansas blizzard, or *calabozo*. As it was for those Americans a hundred years ago, so it is for us of this century. Pinyon incense, so called, is sold in boxes now, and one whiff of it will tempt you to ring up the city ticket office and reserve a place on the next westbound train.

Cherrystone juniper grows up to sixty feet high, or even more, but generally it is much shorter. Often the tree is as broad as high, and usually there are several forks from near the base. In any case, the trunk, however thick and old, is always short, sometimes with branches coming out close to the ground and resting their tips upon it, or, again, the trunk is bare of branches below, revealing its picturesque contortions. With age the trunk becomes fluted and buttressed, covered with twisting strands of soft, fibrous bark. Some specimens are believed to be 500 years old. A trunk only five to seven inches in diameter represents, in general, a life of 175 to 195 years, while trunks ten to twelve inches thick have yielded 315 to 375 annual growth rings.

Probably the most fantastic and ancient specimens, certainly the most exclaimed-over and photographed, are those in The Garden of the Gods, that stage-set of geologic drama, that playground of centuries of erosion and droves of summer tourists, with Pike's Peak for a backdrop. Here, amid fantasies in upturned sedimentary red rocks, are ancients of this race of trees with trunks twisted and crowns lopsided, as if to rival the most extravagant whimsies of this unearthly spot. The juniper known to the Garden guides as "Methusalah" has several enormous stems, all forking from the ground and leaning out from each other, much like the trunks of a crack willow, each one seemingly mighty enough to be the bole of a fair-sized tree, each top with a crown of rich green foliage that, with the red of the rocks and the white of Pike's snows, paint the Garden in elemental splendor. "Methusalah" is claimed, or rather guessed, to be 900 years old. There may be grave doubt of that many, but several centuries at least must have produced such a growth. Although the ground around it is littered with bark strips and dead and broken boughs, there is promise still of indefinite life in this grand old specimen.

The Navajo eats the berries of this juniper in the winter or fall when they are ripe. In times of food shortage, these people chew the inner bark. When the snow is deep, branches are lopped off for the sheep to eat. Wool is dyed green with the bark and berries by the Navajo weavers. The Navajos say that the beautiful margins of their baskets are an imitation of the over-lapping of juniper leaves. To this day in the Navajo war dance a stick of this juniper is carried. All the twigs except a small bunch at the tip are first pruned away and with it is bound a (Continued on page 162)

The Great Horned Owl Nests in March

By HARRY ELMORE HURD

Wind singing through the larch
Intones the hymn of March.

The owl upon her nest
Waits with patient breast.

There is no sign of leaf
To foster her belief:

Nothing now but snow
Interminable below.

Minstrel winds of March
Singing through the larch:

Eggs within the nest
Warm beneath her breast.

Karl Christofferson

Naturalist-Historian of Northern Michigan

By GRACE V. SHARRITT

DR. KARL Christofferson walked over the length of green grass from his cabin door at T Lake, Blaney Park, Michigan, to the flagstaff. He raised the colors of Old Glory to the morning sun. Then he performed the same rite with a Norwegian flag, unfurling its banner in the exhilarating September breeze.

This done, Dr. C., as he is affectionately known by his countless friends in the world of natural history, scanned the lake. It seems to be *his* lake to those hundreds of visitors who each year come to talk, and to gain inspiration from the naturalist-counselor at the wilderness resort in the Upper Peninsula of Michigan.

Dr. C. looked across the lake at a picture that has never grown monotonous to him — blue waters fringed with the green-black of distant trees, the place scented with good earthy things, like pine needles, leaf molds and sun-drenched grasses.

Across the sky flew a familiar wedge. "Blacks," he said, using the pair of binoculars hanging from his neck. "They're getting ready to pull out."

"Do the blacks nest here?" I asked, from where I sat in the warm sunlight.

"Yes," he answered. Just then a flock of Canada geese flew to the shore, screaming wild greetings at him.

"Are these Unkie's children?" I asked.

Unkie was a gander that Dr. C. had befriended some years ago. He and his mate were as much a part of the naturalist's life as the lake and the pines. For almost a span of eighteen years Unkie (who came to Dr. C. in 1930) ruled the roost around T Lake. He died fighting. A coyote finished him off one night when Unkie defended his mate.

But because of the old honker, and his children's children, Dr. C. has established an unusual relationship with the wild geese. Many pairs of Canadas now nest at Blaney and will come to his call and even feed from his hand. By autumn his cabin-yard looks like a convention of wild geese, with snows and blues and Canadas gathering by the hundred for their annual take-off.

One of Karl Christofferson's exhaustive studies has been concerned with solving the riddles of migratory bird flights. Since 1927 he has been making a chart recording flights of waterfowl from his section of the Great Lakes north. In addition to these records, from the return of birds and bands, Dr. C. has come to the conclusion that there is a definite northwest and southeast migration, from his strategic location in the wide area of the Mississippi, or Central flyway. This theory has also been noted by other leading ornithologists.

Dr. Karl Christofferson finds a chickadee in one of his banding traps. He has banded nearly 20,000 birds, purple finches ranking first and slate-colored juncos second.

As he told me that September morning, Dr. C. has had "recoveries" from black ducks found at Port Hope, Albany River district of Patricia, Canada; mallards from central Texas of the southwest; and ringnecks from Manitoba to the northwest and from Florida to the southeast.

However, waterfowl are only one phase of Dr. C.'s studies on the comings-and-goings of bird life in the upper reaches of Michigan, the beautiful wooded country that also embraces the natural resources of copper and iron ore. It is an area bounded by Lake Superior

on the north, where it juts into the cold waters at Keweenaw Point, and, on the south, by the long arm of Lake Michigan where it narrows into the Straits of Mackinac and over into Lake Huron.

Dr. C. is akin to this northland of the waters. He seems to be one with those birds and mammals that come down from the far north to winter in Schoolcraft County near his cabin on the 33,000-acre wilderness resort. And through the years he has become somewhat identified in the minds of his friends with the lives of the early Arctic explorers of the North American continent.

This illusion, which has now become as tangible as the snow buntings, which flock to T Lake in the autumn from the far north, has been strengthened by the naturalist's keen interest in those explorations of Sir John Ross, the discoverer of the magnetic pole; Alexander Mackenzie, who explored the river that was named for him; Amundsen, Samuel Hearne and the rest of those illustrious ones who blazed trails at the northern end of the continent and lived to write their journals.

Around the walls of Dr.'s cabin is a library of priceless, rare editions. His collection comprises such rarities as eight volumes of Audubon's, *Birds of America*, published in 1837; three volumes of Wilson's, *Ornithology*, published in 1832; and a first edition of Nuttale's, *Ornithology*, also published in 1832. His historical and Arctic adventures collection, is the kind that one yearns to linger over and read, losing one's self in the lives of those North American pioneers.

"Unkie" and some of his family at the dock at T Lake.

Dr. Christofferson is proud of his valuable library and well he might be, for it is doubtful that his collection could be duplicated.

"What is this story" I asked him, "about the snow buntings leading you into the study of North American explorations? Is it true?"

Dr.'s blue eyes twinkled. "Of course it's true," he said.

"But how?" I insisted.

I wanted him to talk, to tell me some of his experiences and observations of Nature. It is not always an easy task, because Dr. clams-up when he thinks he is being "lionized." One of the naturalist's biggest "peeves" is the women who make idle chatter about his "adorable" life as a "darling hermit" in the woods! Dr. is a bachelor. He does not dislike women, but he shies from personal questions from either sex.

Not that the rugged Norseman is anti-social. Although he wears a well-groomed, full white beard, which would denote some years, he still waltzes like a college boy. He spends a few weeks each winter in metropolitan centers, attending the theater, concerts and symphonies and visiting art museums and libraries. He is gregarious, but it distresses him to be made an "idol."

"About those buntings. . . . . ." I started to say, when there was a crashing sound in the forest behind the cabin.

He smiled. "A bear," he said. "After the choke cherries. They're crazy about them. Come, let's see."

I was not particularly enthusiastic about tracking down bears, but I wanted to learn more about his study with snow buntings.

Our walk took us through an open meadow. Queen Anne's lace, tall stalks of flowering mullein, and goldenrod were putting on their annual fall flower show. A young sapsucker labored for insects on a dried mullein. Dr. C. told me that you could distinguish a juvenile sapsucker's plumage by the whitish shoulder stripes.

A flight of robins winged in front of us. "Note the white eye ring," Dr. said quickly. "Look how streamlined these robins are and their different coloration."

"For over forty years," he said, "my old friend Michael Magee, of Sault Sainte Marie, and I were aware of these northern robins. They always arrive a week or two after the local or summer robins have departed for the south. Sometimes they come in large numbers, as many as 1000 can be counted in one day! As the black choke and pin cherries are eaten the birds move on to the mountain ash, where they remain for the winter."

"Some day," Dr. C. concluded reflectively, "Some one will divide the two species."

We loitered along the path. Or I did, rather.

"When will the snow buntings begin to arrive?"

"In October," he answered. "My earliest date has been the eleventh. They usually arrive a few pairs at a time. Then, later, the large flocks are seen in the

fields and along the highways. Once, about thirty years ago, Magee and I estimated that there were some 7000 in the fields and on the bare trees back of Sault Sainte Marie. Since then the buntings seem to be diminishing."

I remembered a visit to Blaney one February when Dr. C. was banding flocks of the black-tipped-winged birds. He had told me that he had "returns" from Greenland and from the Gaspe Peninsula. "Further evidence of a northeast passage," he had said.

One bunting that he had banded on Feb. 13, 1942, was found shot, April 6 of the same year, on the eastern tip of the Gaspe Peninsula in Grand Riviere County.

"It is natural," Dr. said, "to assume the birds head from here to the Gulf of St. Lawrence, then north along Newfoundland, and Labrador, jumping across 600 miles to reach Greenland to nest."

"Angel wings," I had called them, with their soft flutterings and softer twitterings, as they flew from one tree-top to another. "Snowflakes," some bird-people call these hardy birds, which on cold days will bury themselves in the snow, with only their heads sticking above the banks. While other bird-watchers use "snow birds," because of their coloration and habits.

From two of his banded snow buntings, the naturalist has had interesting records relating to their age. One bird banded Jan. 20, 1941, returned Nov. 5, 1945, and again Feb. 29, 1948. The other record was of a bunting banded Jan. 22, 1941, returned Feb. 27, 1948, and again the same year on November 27. This would seem to indicate that the life span of the snow bunting could be about seven years.

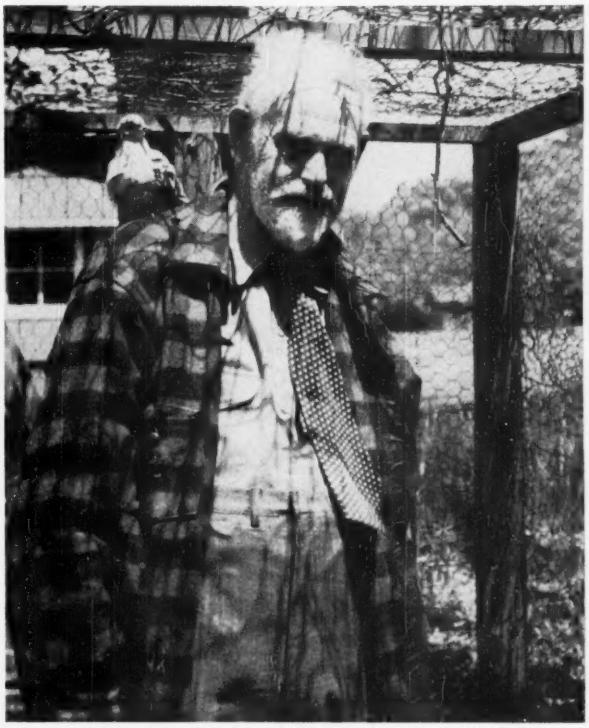
We had now come to the edge of the woods. A vesper sparrow deserted us as we followed the trail into the forest. Along the road were fresh bear tracks, big pad-like prints in the soft sand. Also in the sand, still wet from morning dew, were the sharp indentations of deer, the dainty steps of mice, and the marks of a partridge.

There were black cherry trees with broken branches. There was the scent of sweet fern, that indelible perfume of Michigan's north country. Ground pine, like diminutive Christmas trees, covered the forest floor. There were no birds now, not even the quiet winging of a thrush.

Then, "crack," "crackle," there was that sound again!

Dr. C. went into the shadows of the thicket. "I'll tell him to vamoose," he said, and laughed at my relief.

While I waited in the warm sunlight filtering through the greenery, I recalled tales that have almost become legendary about Dr. C., whose title incidentally is for dentistry, which he once practised at Sault Sainte Marie.



After "Unkie," Dr. C's favorite Canada goose, died, he was bequeathed another bird pet, an Indian ring dove named "Coo," which travels with him, even to the city.

Dr. C. was then, and still is, a great fisherman. He used to be called King of the Fishermen at Sault Rapids. But in the spring of the year dentistry palled, especially in trout season. On many a fine summer day, Dr. would place a card on his office door. "Out. Have gone fishing."

Then one day, so the legend goes, he never returned to his dental office. But he did become naturalist at Munuskong State Park, which has been followed by his twenty years tenure at Blaney.

Since 1921, when he banded his first bird, a long-eared owl that flew aboard a freighter in Lake Huron, Dr. C. had banded (at this writing) 18,540 birds, covering 133 species.

Like his friend the late Michael Magee (see *Nature Magazine*, Sept, 1943) Dr. Christofferson has banded more purple finches than any other species. Also with Magee, he has definitely established an east-west migration route of evening grosbeaks; the finch that looks as though Nature had brushed it with gold, then reconsidering the bird's safety had toned its plumage with markings of black and white. Banding returns from his grosbeaks, have been reported from Presque Isle, Maine; St. Albans, Vermont; and Jamestown, N.Y., to mention a few of the extreme easterly returns.

Then there was the occasion when Mrs. Louise Blake,

Dr. Christofferson at his waterfowl banding traps at T Lake, Blaney Park, Michigan. His banding with these birds has definitely established a northeast-southwest migratory pattern for these waterfowl.

of Potsdam, New York was setting the dining room table for the grosbeaks with choice sunflower seeds. She opened the window and a number of the birds flew inside. Two were caught, to determine their banding records. Strange as it may seem, one of the birds had been banded by Mr. Magee and the other by Dr. Christofferson. The one he had banded was dated from Blaney, Michigan, March 16, 1935. It was caught and released at Potsdam, New York, March 21, 1939, and caught again May 19, 1939, at Amasa, Iron County, Michigan, which is west of Blaney.

Also with Mr. Magee, in 1925, Dr. C. added a new species to Michigan birds, the Gambel's sparrow, the white-crowned sparrow of the West, which is distinguished by the white superciliary stripe starting from a pinkish bill.

Doctor Christofferson also established the first Michigan records of the Arctic great horned owl, and the Labrador great horned owl, which he sent to the Museum of Zoology at Ann Arbor, Michigan.

But of all the birds, and they number a yearly average of about 140 species at Blaney Park, Dr. C. has the strongest attachment to the snow bunting.

As he told me with his whimsical smile, when he emerged from chasing the bear off into heavy timber, "I like to think of how the buntings in the spring cheered those early explorers, like Amundsen and Nansen and Nordenskiold, after they had suffered untold hardships."

"Yes," I thought, as I followed him back to T Lake for lunch. "Dr. C. is uncannily indistinguishable from his beloved north country."

He is timeless. He has the zest of youth, forever on the search for adventure. He can put people, much younger people in years than he, to shame for his faith and hope in America.

While others may feel, "What's the use?" or, "I'm too old to plant a tree, I'll never live to see it mature," Dr. Christofferson is still enthusiastically planting acorns, the seeds of the wild grape, and tree seeds!

By his daily deeds, by his constant reaching out to new fields, and by the thoughtful help to others who may be less stalwart than he, Karl Christofferson has influenced for good countless lives of his friends, both feathered and otherwise.

I like best to think of him raising Old Glory to the morning sun and looking off across T Lake, *his* lake, as if each day holds some clear bright challenge to him.

Crow Talk

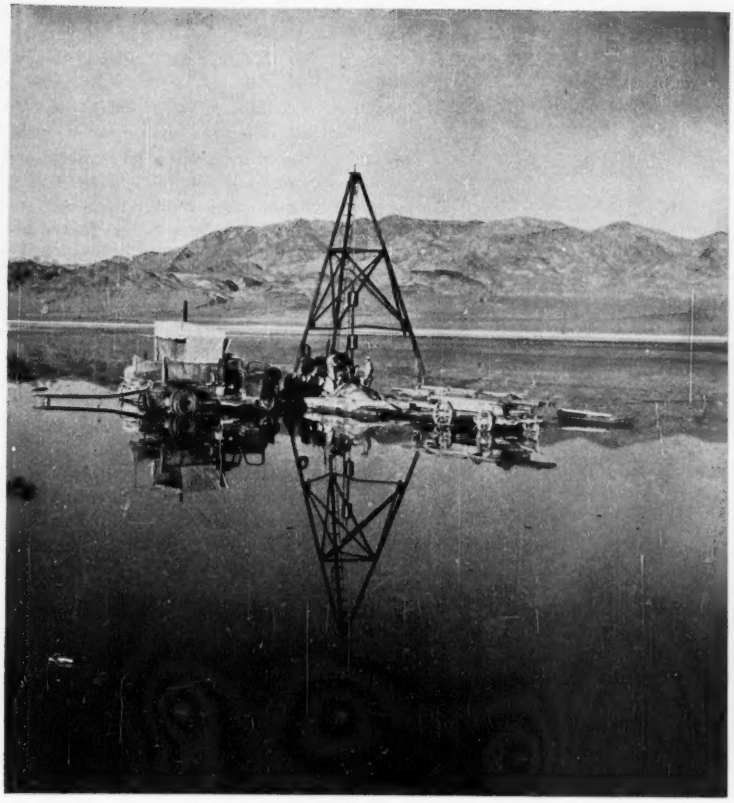
By RICHARD F. ARMKNECHT

All winter long I heard the crows
  Conversing in our little wood.
A *caw*, two *caws* — then silence froze —
  Sparse language which I understood
As well as any crow in all
  The rusty-feathered, starveling lot.
With only hardship to recall,
  Why grumble much at what was not?

But now that we are into spring
  Their raucous bugles fill the hours
With clamor scattered on the wing.
  They *caw* in sunshine, *caw* in showers,
And *caw* especially when they raid
  Fields where our corn is sprouting out.
As for my scarecrow — who's afraid? —
  New corn is meant to crow about!

White Gold of Searles Lake

By
FAVIUS FRIEDMAN



A drilling rig in operation on Searles Lake, source of the brine from which is made agricultural and industrial chemicals. Winter rainwater produces the reflected image on the normally dry lake.

ONLY the gold bonanza itself is the memorial to the luckless pioneers who first stared in disappointment at a fantastic Mojave Desert treasure.

Because those thirsty, red-shirted Argonauts were not hunting for stretches of white salt crystals dotted with pools of bitter brine, they left behind, in California's Searles Lake, a fabulous, 300-foot-thick lode packed with one hundred million tons of precious chemicals to each square mile.

The Searles Lake of today, hugging the northern rim of the Mojave Desert at Trona, between the Slate and the Argus Mountains, is still much as it was when William Lewis Manley, Big Ed Rogers, the Brier Group and the Jayhawker party crossed Death Valley and the Panamints in 1849. Like other sun-parched gold-seekers who came after them, they found no water in the "lake," and water was what they desperately needed. It mattered little to them that the glistening 30-mile salt flat was born during the late Tertiary and early Quaternary periods; that aeons ago it was a great body of fresh water 600 feet deep covering an expanse of 395 square miles, or that a series of climatic changes, which parched the volcanic mountains, transformed the glacial lake into a titanic salt sink.

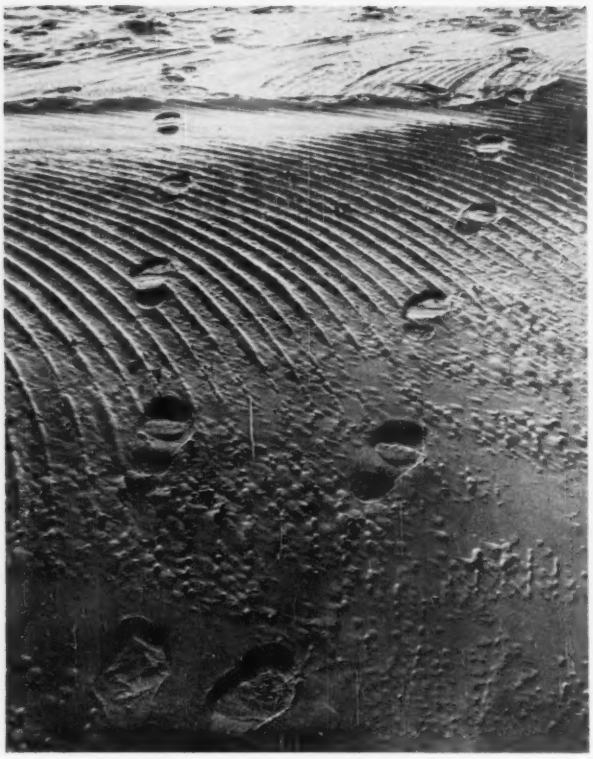
How those bitter white crystals must have taunted the heat-battered pioneers! Yet how could they foresee that within a hundred years wells sunk only seventy feet into the lake would be pumping 3,000,000 gallons of precious yellow brine every twenty-four hours? Or that $20,000,000 worth of potash, borax, salt cake and soda ash would pour each year from the once-reviled basin — now the world's richest deposit of diversified chemicals?

But at least one man was cannier than the gold-seekers who saw and ignored the lake. He was John W. Searles, an old Indian fighter who stumbled upon the thirty-mile stretch of salt crystals in 1862. Searles, who gave his name to the lake, discovered reefs of "trona" on the eastern shore of the basin, and a few years later compared the crystals he had carried away with the borax which Dr. John A. Veatch had found near Red Bluff, California, in 1856.

Seales' find was very much like the Red Bluff borax. It was similar, too, to the even larger deposits discovered in 1864 at Teel's Marsh, Nevada.

Convinced that the crystals of the ancient glacial lake were as valuable as the gold he had once struggled to discover, Searles hurried back to the valley to stake out his claim.

Sometime in 1873 Searles promoted the San Bernar-



Footprints on the salt surface of Searles Lake. Sometimes adventuresome people walk across its surface.

dino Borax Mining Company, named himself president and operated the project with fair success until around 1898. It was during the Searles era that the colorful 20-mule borax teams came into being. In fact, one Salty Bill Parkinson, tough and profane mule skinner, drove the first 20-mule team and mighty, high-wheeled double wagon out of Searles Valley, long before the actual discovery of borax in nearby Death Valley.

Searles' crude plant harvested the borax from the salt flats and prepared it for the long haul to Los Angeles, where it fetched as much as $700 a ton. (Each of the wagons, with rear wheels seven feet high, could hold 12 tons). It was Searles, too, who discovered the first sulphohalite crystals in the lake. These crystals, now much sought after by present-day "rock hounds," were sent off across the continent to the Smithsonian Institution. Ironically enough, the samples came back with a stiff-necked rejection. "These crystals," wrote the Institution, "are not sulphohalite. We have the only two crystals of this material in the world."

Some years later the Smithsonian changed its mind.

Unfortunately for Searles, whose activities were confined to the extraction of borax from the lake, other deposits of the chemical were found nearby. The old Indian fighter withdrew from the area and for ten years the real riches of the huge glacial basin were neglected. The almost infinite variety of precious salts returned to the desert's keeping. They lay there as they had for uncounted thousands of years, after the series of fresh water lakes, beginning in the northern end of the Owens Valley, spread southward, fed by the giant glaciers of the high Sierra, overflowed the Haiwee Divide, dropped some 1500 feet in 30 miles and then rose to such a height that Searles, as well as Salt Wells and Indian Wells Valleys were submerged in one colossal body of water.

After Searles abandoned his discovery, other adventurers tried their luck with the minerals in the dry lake. But despite additional explorations, it was not until 1912 that chemists unlocked the real secret of the desert mystery. The answer to the enigma of Searles Lake — and the bulk of its riches — was not in the solid salts of the surface. The lake's real commercial values lay in the dense yellow brine deep in the bowels of the basin.

Just how fortunate this discovery was for America was proved during the first World War. With Germany the only other world source of potash then, the chemical's price soared to a fantastic $400 a ton. Luckily the new experimental plant established on the fringes of Searles Lake to extract potash and other chemicals from the brine was at least partially successful. But there were still many obstacles, many setbacks and disappointments. The comparatively small brine-processing plant was almost abandoned. But after much experimentation a successful extraction technique was evolved. It is the same process, with modifications, currently employed by the giant American Potash and Chemical Corporation at nearby Trona to produce more than 500,000 tons of salt cake, soda ash, potash and borax every year.

The research director for American Potash has labeled the white gold of Searles Lake as one of the world's great chemical stockpiles. "There are," he declared, "literally billions of tons of soluble salts here. At one spot, about 170 feet down, there is even a stratum of 97 percent pure bicarbonate or baking soda. At present it's merely a curiosity, but some day we may go after it."

Today the glistening surface of Searles Lake is dotted with some twenty-five wells, much like oil wells. Trucks and tractors can be driven across the sixteen-foot-thick crystals of the top layer (some adventurous souls even walk across the lake), but while the yellow brine, in spots, seeps to the surface, the richest chemical-bearing solutions are sixty to seventy feet down. The wells, drilled to the mother liquid, pump the brine in heat-insulated pipelines four miles across the desert to

Specimens of formations found under the surface of Searles Lake at Trona, California. The lake is the world's richest deposit of diversified chemicals.

the refineries. All day and all night 2100 gallons of brine per minute, weighing some ten tons, flow into the American Potash plant to undergo the intricate recovery process that turns these borate minerals into vital chemicals for our everyday life.

All of us who use the by-products of Searles Lake should find some kinship with the fiddle-playing Nero, for he, too, found relaxation in his borax bath. The ancient Egyptians knew and used borax as a water softener. "Trona" itself — a natural double salt of sodium carbonate — is a word that actually derives from the Egyptian. Nowadays most of the world's borax comes from the blistering Mojave Desert, but its price is only a few cents per pound.

While borax is still used as a detergent, the bulk of it now goes to the glass industry. Soda ash extracted from the riches of Searles Lake is used in the treatment of iron and steel, in sugar refining, in water treatment plants, and by citrus fruit packers. Salt cake is employed in the manufacture of kraft paper and board, in the standardization of dyes, in the making of rayons, in soapless powders and in the refining of nickel for use in nickel steel.

The tobacco we smoke and the food we eat are aided in their growth by fertilizers made of Searles Lake potash. When we take a drink of water we probably use a glass tumbler made partly of soda ash; when we enjoy a lithiated beverage like 7-Up, the bottle contains pop made with lithium recovered from the amazing lake. The tub in which we bathe, the clothes we wear, even the adhesive tape with which we bandage little Junior's skinned knee have somewhere within them chemicals pumped from this incredible waterless basin.

But to those early gold seekers it was only so much useless salt. Can you blame them if, in whatever Valhalla they now reside, they sometimes kick themselves in sheer chagrin?

To A Shell

By VELMA FEHLING

Deftly spiraled, pearl-lined cell,
Azure-armored, shining shell,
Does the chemist dare to guess
Your formula for loveliness?
With such curved and balanced flow
Of line and substance, who could know
Of artistry and calculus
Half enough to shape you thus?

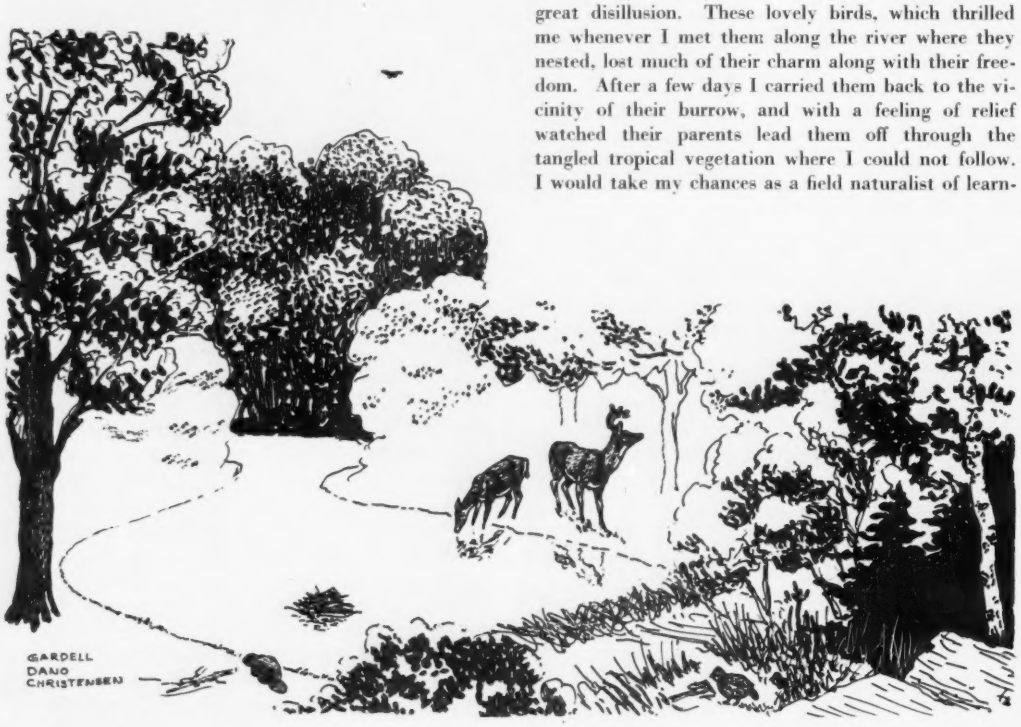
Animal Friends, Dependent and Free

By ALEXANDER F. SKUTCH
Illustrated by Gardell Dano Christensen

THE LITTLE child who is attracted by bright-eyed, winsome creatures in feathers or fur, can seldom live with them in the woodlands and meadows where they are at home. It is difficult for him to become friendly with them unless he keeps them as pets, to be loved and caressed, pampered and indulged, and all too often neglected, starved, and abused. As a child I, too, had a long procession of pets — dogs, chickens, pigeons, peacocks, ducklings, squirrels, a crow, a young whippoorwill, and more others than I can at the moment recall. Each was, for a while, in its master's eyes, the prettiest and most engaging creature on earth, the recipient of lavish attentions; some soon became a burden and a problem; most were mourned or regretted when they died or escaped; but the void left in the young heart by their passing was before long filled by an equally cherished successor.

As I grew up and extended my explorations farther and farther from the parental roof, the fascination of studying many forms of life in their natural surroundings quite displaced any desire to keep animals as captives or pets. Freedom had become a passion with me; I was impatient of all artificial or arbitrary restrictions upon my own liberty, and afflicted by the sight of any creature, of whatever kind, whose freedom had been curtailed. I held that an animal could be considered free only in that environment in which its structure and whole hereditary equipment of appetites and instincts fitted it to live, and I further believed that only beings that were perfectly free could teach us truths of great worth. Hence I avoided domestic and captive animals as unprofitable acquaintances.

The last time that I put a free creature in a cage was more than twenty years ago. I had been studying the habits of motmots and wished to follow the development of the racquet-shaped tail feathers of these beautiful tropical birds. This would require close and continuous observation; so from a nest I had been watching I retained two nestlings almost ready to fly, intending to release them after I had learned what it seemed important to know. But when I saw through the meshes of a cage a bird I had hitherto known only as a shy, elusive free creature, I suffered a great disillusion. These lovely birds, which thrilled me whenever I met them along the river where they nested, lost much of their charm along with their freedom. After a few days I carried them back to the vicinity of their burrow, and with a feeling of relief watched their parents lead them off through the tangled tropical vegetation where I could not follow. I would take my chances as a field naturalist of learn-



ing more about the motmots in their natural setting.

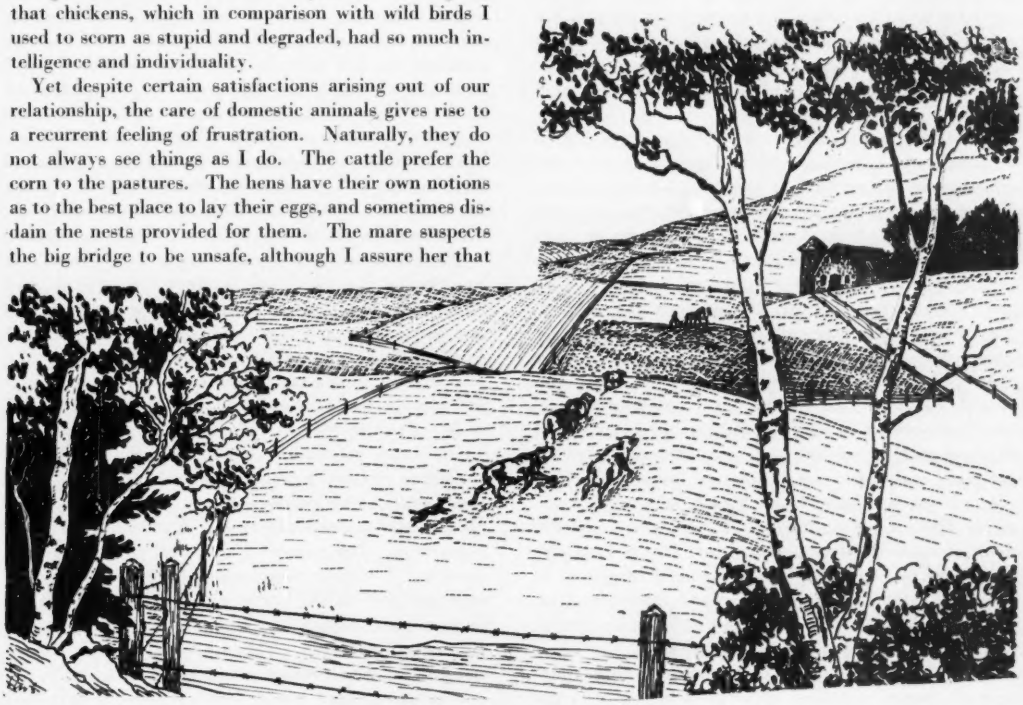
Not long after this, I accompanied a famous ornithologist, now dead, to visit an aviary well stocked with tropical birds. I knew many of these birds in their native habitats; some were elusive, and I welcomed the opportunity to observe them at closer range. But the effect of the aviary upon me was not quite as I had anticipated. I found the sight of the caged birds so distressing that I invented an excuse to escape before seeing all of them.

Although I have not again consigned any creature to captivity, nor kept any animal solely as a pet, I have through force of circumstances become the owner of a number of domestic animals. After I had settled on a backwoods farm, which, because of its isolation, had to be fairly self-sufficient, I found it necessary to acquire first horses, then a few cattle, and finally chickens. I did not wish to exploit these animals, but rather to go into partnership with them. I would give them food, shelter, medical attention when sick, in short treat them with kindness and consideration, as friends rather than as slaves. In return, they would provide me with transportation, traction, milk, or eggs. This seemed a fair exchange of services, from which both they and I would profit. To a certain extent, it has worked out as I had hoped. Aside from occasional illness, the farm animals seem content and even happy. They have on the whole paid for their keep, and I have grown attached to some because of their personal charm. Before I began to know them intimately, I never imagined that chickens, which in comparison with wild birds I used to scorn as stupid and degraded, had so much intelligence and individuality.

Yet despite certain satisfactions arising out of our relationship, the care of domestic animals gives rise to a recurrent feeling of frustration. Naturally, they do not always see things as I do. The cattle prefer the corn to the pastures. The hens have their own notions as to the best place to lay their eggs, and sometimes disdain the nests provided for them. The mare suspects the big bridge to be unsafe, although I assure her that it will bear us safely across the river. These conflicts of will make it necessary to drive, to confine, to use force, at times even to severe application of the whip. Unless some discipline is preserved, the farm will become chaotic; and I seem to be the unfortunate one elected to maintain it.

As I grow older, it becomes increasingly distasteful to me to impose my will upon any being. With the passing of the years, I have discovered that I have quite enough to do in disciplining myself, my thoughts and emotions and impulses — in keeping my own house in order. Self-discipline is the only kind that is of much worth. So long as we are self-disciplined we are free. When we must be disciplined by others, or are called upon to discipline others, we fall into one kind of bondage or another; in the first case we are held down by others, in the second we are pulled down by others.

The lust for power is the most pernicious of human weaknesses, the cause of more misery than any other. Power through political position, power through social status, power through wealth, power over our children, power over our employees, power over our domestic animals — is not the craving for any of these a manifestation of the same spiritual frailty? The enlightened man seeks to guide others by rational persuasion, by example, by the contagion of his enthusiasm; he shrinks in spiritual stature when he must resort to compulsion. Although we are sometimes forced to use



force, we should for our spirit's sake avoid such occasions to the limit of our ability. Humility is a virtue difficult to define, and the attempt to cultivate it has led to some strange paradoxes. But if we mean by humility reluctance to impose our will upon others, it is one of the foremost among all of the moral virtues.

Despite good intentions, the care of dependent animals calls for the frequent exercise of compulsive force, and so involves a spiritual danger. But our relations with free animals have an exactly opposite tendency. When we wish to cultivate their friendship, we must assume a conciliatory rather than a dominating attitude. Instead of bending them to our will, we await their spontaneous action. This might also be an undesirable situation if they were exploiting us or deliberately subjecting us to their whims. But they ask nothing of us except to be allowed to go their ways in peace. Much of the time while we watch they are heedless of us — indeed, this is the most satisfactory manner of becoming acquainted with them. When we wish to watch a bird build her nest or attend her young, to see a beaver or a muskrat at work, to follow the movements of a herd of deer, we wait for the unfolding of millenial instincts, which long antedate the individual will, rather than for the arbitrary decision of a particular animal. We can, if we are inexpert and make our presence too evident, delay the performance of the activity for which we watch; but we can not compel it. This need to be patient and self-effacing is salutary for our human egotism, which needs chastening rather than flattering. It is an exercise well fitted to make us gentle and humble.

Or if, instead of trying to cultivate a feeling of friendship and sympathy with free animals through discovering the secrets of their lives without their becoming aware of our interest, we elect a different approach and attempt to become intimate with them through breaking down their distrust of us as humans, which is the unhappy result of centuries of persecution, we shall need to exercise much the same qualities of mind. To lure the timid wild creature to take food from our hand, or to accept our unconcealed presence beside its nest, calls for vast amounts of patience, tact, and humble courtesy. An abrupt movement, a loud noise, an ill-considered gesture of familiarity, may cancel hours of persevering diplomacy. In any case, when we associate with creatures unsubdued by man we feel that we are dealing with our equals, who are free because they are self-disciplined, as we wish to be. Indeed, at times we suspect that we are face to face with our superiors. It is hardly possible to feel this way in regard to animals that are captive and dependent upon our arbitrary authority. It is more wholesome for us to associate with equals than with inferiors.

Of all the benefits we can derive from the contemplation of Nature, the most precious is insight into the harmonies that it enfolds. These harmonies in animate Nature are, it is true, only limited and relative, so that if we follow them far enough they invariably terminate in discord — in that ceaseless strife and competition between individuals and species which we have come to call "the struggle for existence." Yet despite its restricted scope, also despite the dark and gory matrix of conflict amidst which we find it, each harmonious pattern is a sacred revelation, a precursor or imperfect symbol of some ampler harmony that ceaselessly strives to fulfill itself amidst the enveloping gloom — a hint of some divine order struggling to emerge from chaos.

These harmonies are of various orders and degrees. First there is the internal harmony between cells and organs, processes and functions, without which no organism, however humble, could continue to live. Then there is the harmonious adaptation of the organism to the environment in all its aspects, which is equally essential to the maintenance of life. Of a still higher degree of complexity, hence more difficult to achieve and to preserve, are the social harmonies between individuals of the same kind, or even between animals of distinct species. When we watch birds rear their offspring, witnessing the nice coordination of the activities of the male and female who assist at the nest, and the fine articulation of the behavior patterns of parents and young, observing also how the restriction of breeding pairs to definite, mutually recognized territories diminishes conflict between them, we behold a social harmony of marvellous perfection within its limited sphere. When we watch a friendly company of birds of perhaps a dozen species foraging through the woodland, or when we understand how the many kinds of birds nesting in a garden or an orchard rear their families with little interference from each other, we recognize a loose society that transcends the limits of species.

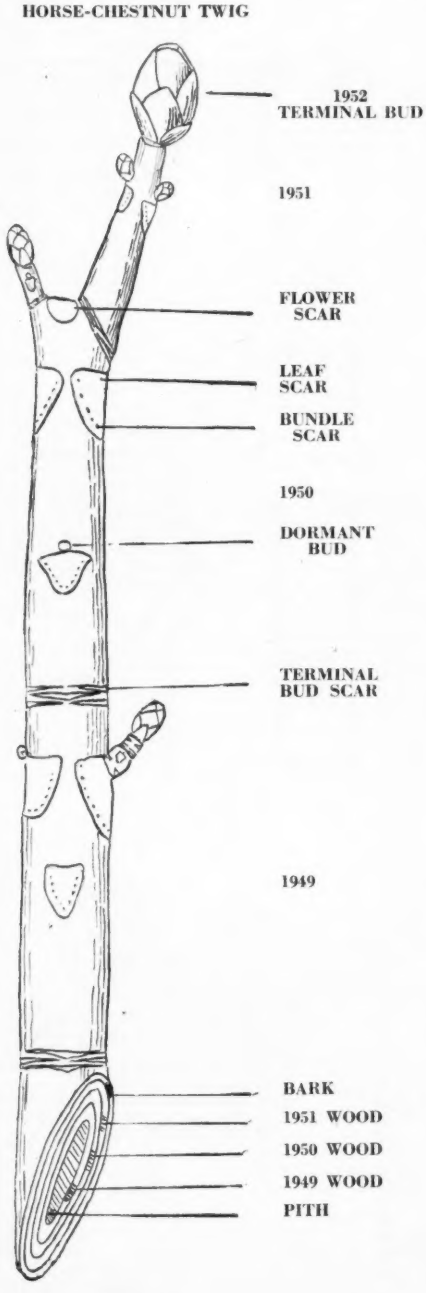
These harmonious adjustments between the parts and functions of the individual, between the organism and its environment, between members of the same species, and between animals of diverse species, were perfected slowly during the course of countless generations. We seek in vain among our dependent animals for adjustments as perfect as those that we discover in free animals. They are not so well adapted to their environment, hence are on the whole less hardy and more subject to disease. Compared with the nicely balanced social relations we witness in many free creatures, those of domestic animals are crude, disorderly, and often repugnant. The causes of this lack of harmony are obvious. We have transported our domestic animals over the face of the earth without much regard for their original adaptations to climate, soil, vegetation, and associated fauna. This accounts for their lack of hardiness and vulnerability to plagues of all sorts. On our farms we herd to- (Continued on page 162)

Winter-Buds and Twigs

Of Some Common, Opposite-Budded, Woody Plants

By E. LAURENCE PALMER

This is the sixty-fifth in NATURE MAGAZINE'S *series of educational inserts.*



IN LATE winter and early spring most of us look, more or less anxiously, for signs of spring. We watch for migrating geese and other birds. We listen for peepers, dig for earthworms when the urge to go fishing hits us. We may even be cheered to think of warm weather ahead when we see the first housefly.

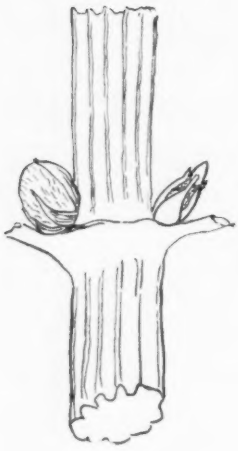
Even surer and more orderly than these signs are the developments that take place every spring on the finer twigs of our common woody plants. We may bring an apple twig, or a branch of forsythia, into the house to force the bloom, but really, to an observing person, there is enough of importance going on regularly each spring, from the time the red and silver maples and the elms begin to burst their buds and to flower, until the more conspicuously flowered species break into glorious bloom.

For reasons to be explained, we elect this time to deal with woody plants whose buds are opposite, and we choose species that range from early-flowering silver maples to late-flowering catalpas. Because of this it is almost certain that when this appears in print there will be, in your neighborhood, some woody plants that have bloomed for the year, some that are about to bloom, and some that will bloom later. A few may actually be in bloom as you read this. Let us look at a few of them a bit critically.

To understand the descriptions on the next few pages it may be well first to gain some understanding of the important anatomy of an average twig of a woody plant. We are this time interested in those whose buds are opposite each other, or in whorls of three. The sketch to the left may be of help.

Three kinds of buds may interest us. Some of our plants bear buds at their ends. These, of course, are usually *terminal buds*. Usually, but not always, they are larger than the others. They may develop into leaf-bearing twigs, or into flower clusters. If they are to bear flowers the future direction of the twig will be modified and a fork will be formed. The buds to the side of the terminal buds, and from the sides of the twigs, are lateral buds, some of which produce leaves and some flowers. Usually the flower producers are the larger. Generally buds of our woody plants are enclosed in *bud scales*.

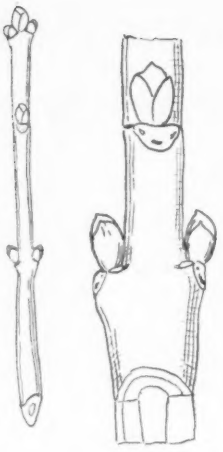
Usually below a bud is a scar of varying size and shape. These are probably *leaf-scars*. From the corners of these we sometimes find secondary scars that bore little leaf-like structures. These are *stipule scars*. In alternate-leaved woody plants (*Continued on page 144*)



Virgin's Bower

Clematis paniculata

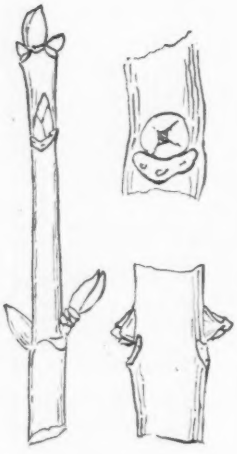
Buds: oval or elliptic in leaf-base axils pointing between leaf base and stem.
Bud scales: Outer, smooth and slender; inner, somewhat hairy.
Leaf scars: not evident as leaf bases persist.
Bundle scars: not evident as leaf bases persist.
Twigs: straw colored, with 12 to 18 ridges, not smooth or with bloom.
Pith: with bundles corresponding to each ridge.



Bladdernut

Staphylea trifolia

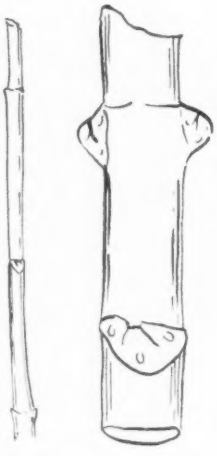
Buds: oval, rather plump, blunt pointed not spreading from or clinging to stem.
Bud scales: smooth, with 4 scales exposed.
Leaf scars: almost hemispherical, somewhat swollen, with slender stipule scars.
Bundle scars: three or apparently so.
Twigs: rounded, relatively smooth.
Pith: large, white.



Hydrangea

Hydrangea (1) *petiolaris*, (2) *paniculata*

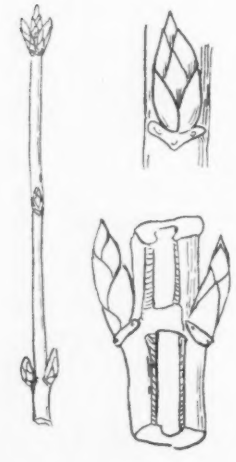
Buds: (1) pointed, often on short leaf-scarred twigs. (2) blunt, pointing at right angles to twigs.
Bud scales: (1) pointed, triangular. (2) blunt, wider than long.
Leaf scars: slightly protruding, somewhat corky crescents.
Bundle scars: three, sunken or raised.
Twigs: round, rather coarse, large pithed.



Syringa, Mock Orange

Philadelphus pubescens

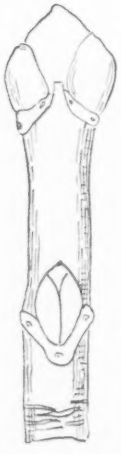
Buds: usually hidden in leaf scar or barely bursting through them; exposed in *P. hirsutus* and *P. lewisii*.
Bud scales: where showing, few, blunt.
Leaf scars: semicircular, membranous, connected by line.
Bundle scars: three, separated, distinct, small crescents. No stipules.
Twigs: varying in color with species, brittle.



Deutzia

Deutzia scabra

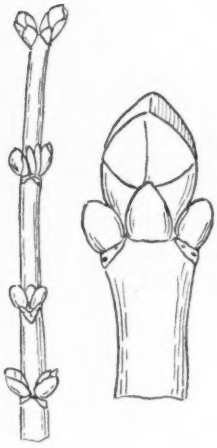
Buds: pointed at tip, widest near or just below middle.
Bud scales: with 3 to 4 pairs showing, pointed; in *parviflora* finely haired and more blunt.
Leaf scars: pointed at sides, triangular to crescent-shaped, somewhat distended and corky.
Bundle scars: three, separated.
Pith: brown in *scabra* and hollowed; white in others.



Box Elder

Acer negundo

Buds: terminal, $\frac{1}{8}$-$\frac{1}{4}$ in. with 2 dull red, usually fuzzy outer scales; lateral, pressed to stem, blunt, few-scaled, gray-hairy or with bloom.
Leaf scars: relatively narrow, notched above, somewhat corky.
Bundle scars: three, well separated, distinct.
Twigs: greenish to purple with waxy bloom that rubs off easily, of medium coarseness.



Red Maple

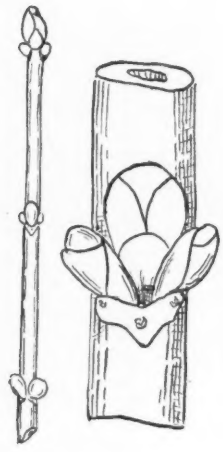
Acer rubrum

Buds: blunt, dark red; terminal about ⅛ in. long; 2-3 flower buds clustered at nodes.
Bud scales: relatively few, opening early.
Leaf scars: well defined, notched above, somewhat 3-lobed at times, little swollen.
Bundle scars: three, distinct, sunken.
Twigs: rather slender, red to gray, not ill smelling.

Striped Maple, Moosewood

Acer pennsylvanicum

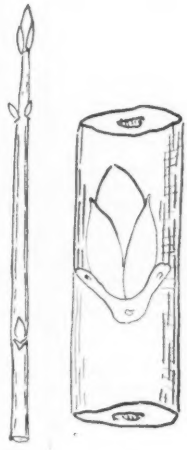
Buds: usually bright red, short stalked. Terminal: to ½ inch long; lateral, smaller.
Bud scales: few, usually showing single pair, keeled, smooth, red.
Leaf scars: deeply V-shaped, light colored.
Bundle scars: 3 to usually 5, unevenly grouped, sometimes over 5.
Twigs: slender, straight, light green, smooth, mottled with black.



Silver Maple

Acer saccharinum

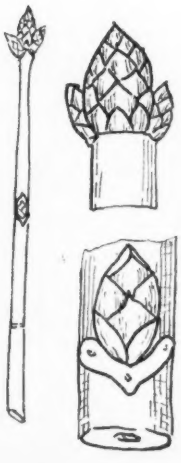
Buds: dark red, blunt; terminal about ¼ in. long; flower buds clustered at nodes.
Bud scales: few, more pointed than in red maple, crowded.
Leaf scars: well developed; notched above, slightly swollen, light.
Bundle scars: three small crescents.
Twigs: smooth, gray-red, ill-smelling.



Mountain Maple

Acer spicatum

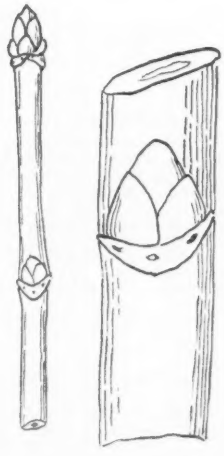
Buds: bright red, relatively small and slender. Terminal containing flowers, to ⅛ in.
Bud scales: few, pointed, relatively slender.
Leaf scars: slender V-shaped, clean-cut.
Bundle scars: apparently 3 but may be more in three groups, elliptic to circular.
Twigs: slender, bright red, with appressed gray hairs towards tip.



Sugar Maple

Acer saccharum

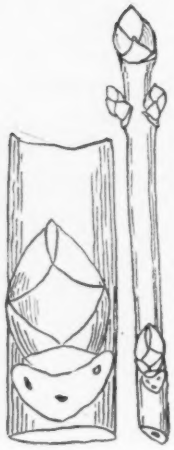
Buds: small, pointed smooth, color of maple sugar. Terminal: to ¼ in. long. Lateral: smaller pressed to twig.
Bud scales: many, somewhat pointed. smooth in Sugar M., hairy in Black M.
Leaf scars: narrow, V-shaped, distinct.
Bundle scars: three, distinct, separated.
Twigs: slender, russet.



Norway Maple

Acer platanoides

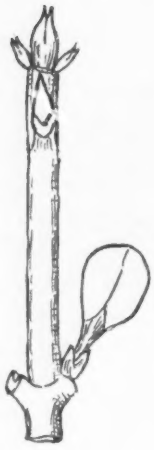
Buds: reddish or yellow green towards base or dull red-brown. Terminal: to ¼ in. long. Lateral: smaller, pressed to twig.
Bud scales: broad, strongly keeled, smooth, milky-juiced when broken.
Leaf scars: somewhat swollen, triangular crescents, connected in pairs.
Bundle scars: usually 3, distinct, separated.
Twigs: stout, shiny, brown to green brown.



SYCAMORE MAPLE

Acer pseudo-platanus

Buds: terminal, ½ to ¾ in., bright green, blunt. Lateral, small and spreading from stem somewhat.
Bud scales: somewhat keeled, smooth, 2-4 pairs showing, rather bluntly pointed.
Leaf scars: rather broad crescents, slightly swollen.
Bundle scars: usually 3, distinct, sunken.
Twigs: coarse, straight, smooth.



CORNELIAN CHERRY

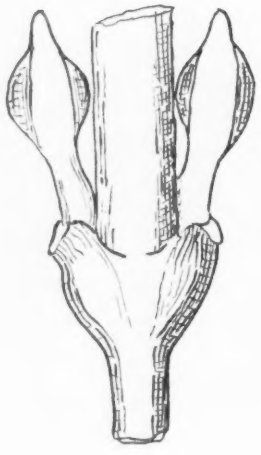
Cornus mas

Buds: flower buds almost spherical, to ¼ inch through, commonly on short spurs. Leaf-buds: slender pointed, to ¼ inch long, with terminal flanked by 2 smaller lateral buds.
Bud scales in leaf buds: slender, pointed green to red tipped.
Leaf scars: narrow lines.
Bundle scars: 3, inconspicuous.
Twigs: green to red, rubbery.

HORSE-CHESTNUT

Aesculus hippocastanum

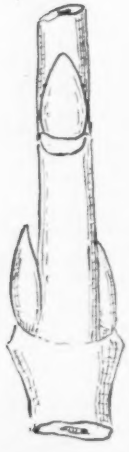
Buds: terminal, to 1½ inches long, brown, glistening with sticky gum. Lateral: spreading from stem.
Bud scales: keeled with to 4 pairs showing, somewhat pointed. Related buckeye lacks sticky gum and is smaller scaled.
Leaf scars: broadly triangular, straight tops.
Bundle scars: many, in a V-shaped line.



BLOODTWIG DOGWOOD

Cornus sanguinea

Buds: stalked, spherical but showing a pointed area beyond the sphere.
Bud scales: a single pair normally showing, or not more than two pairs, may be fuzzy.
Leaf scars: swollen at base, joined in pairs with line.
Bundle scars: 3, well separated, somewhat sunken.
Twigs: red or often green.



PANICLED DOGWOOD

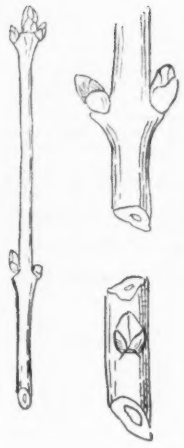
Cornus racemosa

Buds: elliptic or ovate showing 3-4 pairs of veins. Lateral buds: with tips pressed to stems. Flower buds not prominently enlarged.
Bud scales: few, but one pair showing normally.
Leaf scars: raised beyond twig outline.
Bundle scars: 3, separated.
Twigs: light brown, with appressed fuzz, slender.
Pith: white or pale brown depending on age.

FLOWERING DOGWOOD

Cornus florida

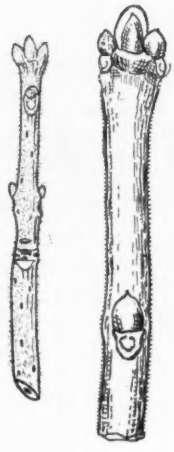
Buds: lateral, minute and covered by leaf bases. Lateral, flattened spherical, flower bearing, red, usually downy at tip.
Bud scales: 2 pairs making flower bud to 1/3 in. long. Leaf buds: slenderer.
Leaf scars: narrow crescents or obscured by leaf bases.
Bundle scars: 3, often in one close group.
Stipule scars: absent.
Twigs: rubbery, bright red or yellowish green, smooth.



Privet

Ligustrum vulgare

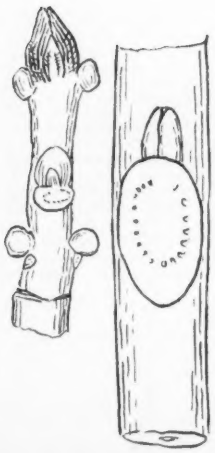
Buds: terminal, oval to conical, to ⅛ inch long. Lateral: smaller and often not exactly opposite, one being lower than the other.
Bud scales: with 3-4 pairs showing, greenish or reddish, with light borders.
Leaf scars: swollen, with dark surfaces sometimes with ridges down stem from outer limits.
Bundle scars: not plain to naked eye, hidden in part in leaf scars.
Twigs: greenish to brown.



Red Ash

Fraxinus pennsylvanica

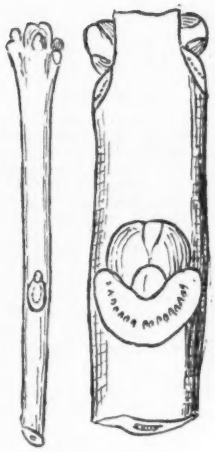
Buds: dark, rusty brown, with terminal and laterals about equal in size, like pointed spheres.
Bud scales: about 2 pairs show in terminal bud, fuzzy.
Leaf scars: conspicuous, broad shields or semicircles. Top margin nearly straight.
Bundle scars: in almost closed ellipse, many almost forming single line.
Twigs: rather coarse and velvety at most times of year.



Black Ash

Fraxinus nigra

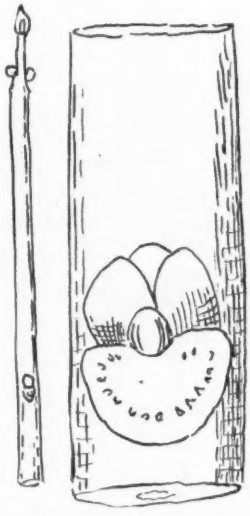
Buds: terminal, bluish black pointed cones or spheric cones. Lateral, smaller spheres not closely pressed to stems.
Bud scales: keeled in terminal bud with not over 2 pairs showing, narrower than in white ash.
Leaf scars: almost elliptic, swollen, somewhat corky, upper margin not concave and may partly cover bud.
Bundle scars: in almost closed ellipse, many, rather distinct.



White Ash

Fraxinus americana

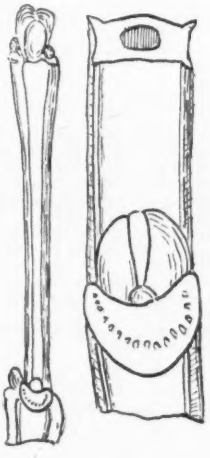
Buds: terminal to 1/5 inch long, blunt, generally broader than long. Lateral buds at tip near top terminal bud but are smaller.
Bud scales: 2-3 pairs are visible, with those of terminal bud with sharp points that may be shed.
Leaf scars: large, raised, crescent or semicircular but always notched at top.
Bundle scars: numerous in curved line, almost continuous.



Green Ash

Fraxinus lanceolata

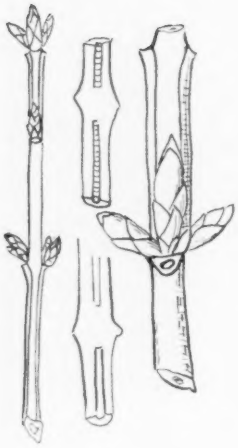
Buds: terminal larger than lateral, flattened oval, pointed with rusty fuzz.
Bud scales: but 2 pairs visible, mostly broad, blunt, close.
Leaf scars: semicircular, upper margin notched slightly but nearly straight.
Bundle scars: many, in almost closed heart, distinct.
Twigs: smooth, not velvety.



Blue Ash

Fraxinus quadrangulata

Buds: gray, woolly; lateral, blunt. Terminal: large and blunt with 2 small laterals at side.
Bud scales: 2 pairs showing usually, woolly.
Leaf scars: large crescents with upper margin concave rather than notched.
Bundle scars: distinct, many in curved line, not closed or partly closed ellipse.
Twigs: conspicuously 4-sided with angles winged.



GOLDEN BELL

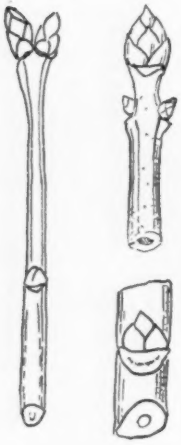
Forsythia viridissima

Buds: to $\frac{1}{2}$ inch long, more or less pointed at both ends, with tips well away from the stems. In laterals, many flower buds at a node.
Bud scales: with to 6 or more pairs showing.
Leaf scars: thickened, with decurrent lines.
Bundle scars: one.
Stipule scars: none.
Twigs: brown, ridged.
Pith: solid at nodes in *intermedia* and *suspensa*.

CATALPA

Catalpa speciosa

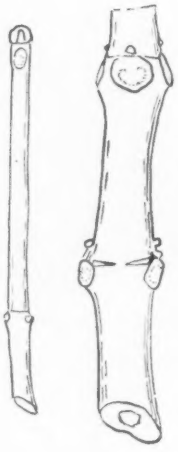
Buds: whorled in threes, terminal bud, absent; laterals, hemispherical, usually under 1/6 inch high.
Bud scales: 5 or 6 visible, brown, loosely overlapping, blunt usually.
Leaf scars: large, round, depressed in center but swelling nodes conspicuously.
Bundle scars: many, in closed ring, often raised.
Stipule scars: absent.
Twigs: stout, reddish or yellowish, smooth.



LILAC

Syringa vulgaris

Buds: usually with 2 buds at tip, plump, pointed egg-shaped, smooth, not pressed to stem at tips.
Bud scales: usually with 4 pairs showing, bluntly pointed.
Leaf scar: thin crescent, raised from twig surface.
Bundle scar: one, a line.
Stipule scar: absent.
Twigs: coarse to slender, usually somewhat angled, smooth.
Pith: rounded, pale.



BUTTONBUSH

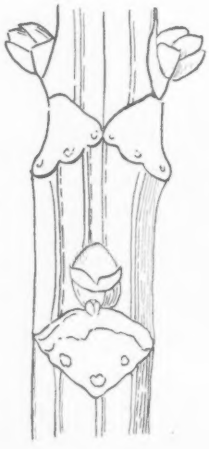
Cephalanthus occidentalis

Buds: usually in whorls of three, relatively small cones, apparently buried in twig. No terminal bud.
Bud scales: small and inconspicuous to naked eye.
Leaf scars: round, raised, swelling twig at nodes.
Bundle scar: one forming a rather large C opening upward.
Twigs: round slender, smooth.
Pith: continuous, light brown, somewhat 4-5 sided.

PAULOWNIA. IMPERIAL TREE

Paulownia tomentosa

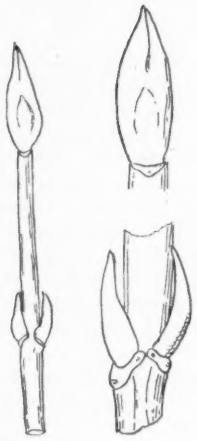
Buds: hemispherical, blunt, with one or two above a single leaf scar one above the other, sunken in twig.
Bud scales: about 4 exposed and these ragged at tips.
Leaf scars: elevated, nearly oval, large.
Bundle scars: numerous in an almost closed ellipse.
Stipule scars: lacking.
Twigs: coarse, constricted at nodes, minutely velvety.
Pith: large, white, chambered or hollow between nodes.



BLACK-BERRIED ELDER

Sambucus canadensis

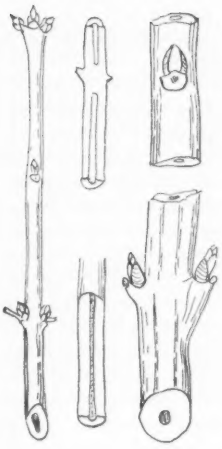
Buds: conspicuous, somewhat spherical, green or brown, spreading from stem.
Bud scales: about 3 pairs showing, with lower set broader than upper.
Leaf scars: almost diamond shaped, large, raised, conspicuous.
Bundle scars: usually 5, arranged in a V.
Twigs: coarse, often ridged, light brown.
Pith: white; in red-berried elder it is brown or red.



NANNYBERRY

Viburnum lentago

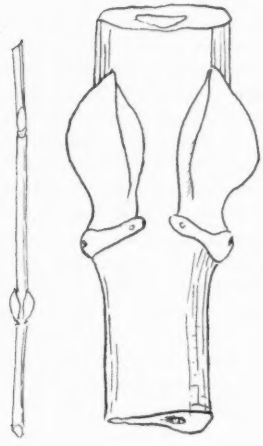
Buds: terminal, flower-buds to ¾ inch long, pointed, protected by 2 gray or red downy scales. Later buds more slender with tips pressed to stem.
Bud scales: usually but one pair shows per bud.
Leaf scars: broadly V-shaped, slightly raised.
Bundle scars: 3, well separated.
Twigs: slender, roughened, gray or light red, ill-smelling when broken.



CORAL BERRY AND SNOWBERRY

Symphoricarpos orbiculatus and *S. albus* (shown above)

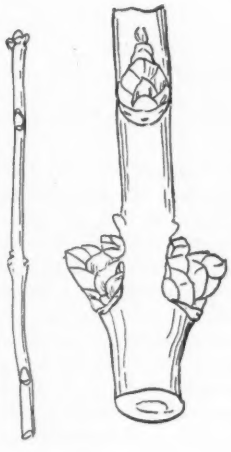
Buds: small, slender, ovals in axils of old leaf bases, tips not pressed to stem.
Bud scales: showing 2 to 3 pairs, not loosely spreading.
Leaf scars: semicircular or represented by persistent leaf bases.
Bundle scar: one, small.
Twigs: fine, ridged in coral berry.
Pith: continuous in coral berry; interrupted in snowberry.



SNOWBALL BUSH

Viburnum opulus

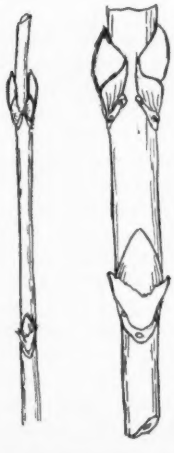
Buds: elliptical but pointed at tip and definitely constricted at or above the base.
Bud scales: usually a single pair showing.
Leaf scars: 3-lobed V-shaped, somewhat raised.
No stipule scars.
Bundle scars: 3, well separated.
Twigs: straight, smooth, rather coarse.



TARTARIAN HONEYSUCKLE

Lonicera tatarica

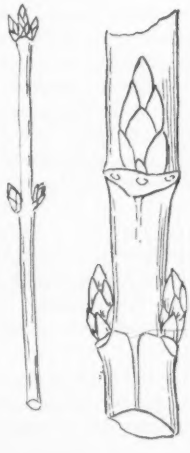
Buds: blunt, stout, cones with secondary smaller buds above the main buds, the uppermost in a series being the smallest.
Bud scales: with 5 to 6 or more pairs showing, each broad and blunt, smooth.
Leaf scar: relatively narrow crescents or V-shaped.
Bundle scars: 3, well separated.
Twigs: gray, brittle somewhat ridged.



ARROW-WOOD

Viburnum dentatum

Buds: twice as long as wide, pointed, elliptic, with tips pressed to the stem.
Bud scales: a basal and an inner scale showing, with the basal deeply notched.
Leaf scars: V-shaped, relatively narrow, not unduly swollen.
Bundle scars: three, well separated.
Twigs: downy when young but smooth when old, straight and stiff.



BUSH HONEYSUCKLE

Diervilla lonicera

Buds: pointed egg-shaped with tips not too closely pressed towards twig.
Bud scales: with 4-5 pairs showing and with tips of scales not diverging.
Leaf scars: wide Vs or indistinct crescents with lines running down stem from 3 points.
Bundle scars: three, well separated.
Stipule scars: lacking.
Twigs: round in cross-section.
Pith: continuous.

(*Continued from page 137*)

these are most helpful in making classifications. Inside the leaf scars are usually one or more scars, marking where the food canals, or bundles, to the leaf broke off. These are *bundle scars*, or *bundle traces*, and are most helpful in identifying most woody plants.

The pith inside may be of importance in identifying some twigs, as you will see when you use these pages.

Some people may wonder why anyone should get excited about knowing woody plants in their winter condition, or, for that matter, knowing about woody plants at any time. But it happens that these plants provide us with shade, lumber, food, soil anchorage, fiber, fuel, tools, pulp and many other basic resources. You cannot start an ash plantation by transplanting other seedlings, and in fact most woody plants that we buy for transplanting come to us in the winter condition. If we want a low shrub in front of a window it does not pay to plant a tree there that will grow too tall. If we want a yellow splash of color in our hedge it pays to know the difference in the winter condition of such plants as forsythia and syringa. One will give us yellow and the other white. If we are planning our hedge to give us a show through the season we should know how to identify early blooming plants and those that will bloom late. So it is not enough just to know that a plant is a woody plant.

In earlier numbers of this series we have considered woody plants through identification and understanding of their wood; and through appreciation of their shade-producing properties. We have considered Christmas trees, nut trees, fiber producers and other important aspects of trees and shrubs. One number dealt with the edible fruits of woody plants. We hope that this unit will be so interesting that readers may want some future units on woody plants with alternate buds. It seemed that the selection of opposite-leaved plants would simplify our problem, and that is why we made this selection.

For the benefit of those who wish to attach an economic importance to everything they learn, let us point out that those who manage woody plants can increase yields tremendously by proper pruning, or by grafting. Certainly one starting to prune a woody plant should be able to distinguish between the buds that will produce leaves and those that will produce flowers and fruits. Pruning away all the flower buds would destroy the crop of fruits. Similarly, the over-pruning of the leaf-producing parts of the plant may affect the fruit crop. One cannot get food into fruits unless there are leaves at work yielding that food.

It is also most important that we be able to distinguish between young and old wood; and that buds on the new wood are usually more likely to develop. In some plants we find no buds on old wood. Thus, if we want fruit, we must maintain a proper balance between leaf-bearing and fruit-bearing wood.

If we are interested in growing forest trees it is worth noticing how clean, straight trunks are produced, and how these may be spindly when too crowded, or knotty when too widely separated. What you observe about the development of the twigs suggested by this insert may give you considerable power in the management of some woody plants, to the end that the yield to you may be greater. You may develop the habit of not breaking off lead twigs in plants the future value of which depends on a long, straight trunk. You may make it a practice to cut these growths back if you want a thick canopy, as in a privet hedge. The more those leads are cut the more lateral buds will be developed, and the denser will be the hedge. When, through the help of this insert, you discover that lilac blooms appear at the tips of branches, and that forsythia blooms appear from lateral buds, you have something to remember when you trim your hedge later in the year.

Of course, there is always some satisfaction to some of us in just knowing about Nature for the pure fun we get out of it, whether it helps our pocketbook or not. We are the ones who make collections of twigs and buds, and try to learn to distinguish not only the major groups but the finer differences in closely related plants.

I rather think I got my first interest in woody plants from a leaflet that came into my hands when I was in the third grade, but that was nothing compared to the fun I got when, in freshman English, I read about someone who had noticed how black the buds of ash were. I had never noticed it, and I am sure the professor never had, but on my way home that day I sought out an ash tree and sure enough the buds were black. How disappointing it would have been had I happened to have found a red ash, a green ash or a white ash. It was years before I learned the relative importance of the different ashes in woodcraft, or even as lumber, and it was a long while before I learned to identify them by their fruits as they were to be found drifting over snow banks in winter, or spotting the ground on a woodland trail, or in windrows on a common city sidewalk. Once I had discovered how ashes flower and develop their fruits they have continued to hold my interest each year. The same has held for the maples, the viburnums, the dogwoods, and for other woody plants, many of whose buds and twigs are shown here.

It is strange how careless botanists have been in giving information on the winter characters of woody plants. Most illustrations ignore the important details, even books that make some effort to be technical. One of my former teachers, now unfortunately dead, wrote a number of books on trees, but for the most part they have missed the details that really give me a thrill, and seem to have avoided giving distinctive characters that may settle, for once and all, a needed identification. Maybe sometime, when I have the time, I will write the kind of book that should give those details. No one has done the job justice as yet, and while there are tons of books dealing with the summer aspects of woody plants that you cannot transplant, there are very few giving you the characters of plants in a condition when they can be safely transplanted. It is useful to know of this vacuum in Nature literature. Maybe we can help fill it one day.

Let's Protect Our Investment

ANY home-owner who lets his house go without paint, his lawn grow up to weeds, his fences rust or rot away, his foundations be eaten out by termites is throwing away what he owns. Any industrialist who lets his machinery rot and his plant run down is inviting bankruptcy. Yet the American people are following just such short-sighted practices with respect to an increasingly important resource — the recreational value of the national forests.

Let us take a quick account of stock. Within the national forests we have 4400 camp and picnic areas capable of serving 280,000 persons at the same time. We have 190 swimming areas with a capacity of 28,000 people, and 208 winter sports areas that can take care for 150,000 patrons at one time. The facilities in these areas represent an investment value of more than thirty million dollars, and could not be replaced at today's costs for seventy-five millions. In 1950 thirteen million visits, totalling seventeen million man-days of use, were recorded for these reservations. A ten percent increase in use for 1951 is regarded as a conservative estimate.

Weekend and holiday use of many popular areas is often more than double the planned capacity. Overcrowding results in serious damage to the forest environment, hastens the breakdown of existing facilities, and reduces the enjoyment of the forest by the users. Sanitary provisions are in most cases woefully inadequate, and this condition holds the constant threat of illness, even epidemics. Yet, since 1940, the United States Forest Service has had virtually no funds for new construction.

In the appropriations for the Forest Service for the 1952 fiscal year a sum of $611,000 is provided for management of the recreation resources. This must cover such activities as cleanup, sanitation, garbage disposal and administrative costs. About $400,000 are available for maintenance. Put another way, total funds provide about six cents per man-day of use for cleanup and maintenance. Figures for recreation areas that are kept up to a satisfactory standard show that about twenty cents per man-day use is necessary to protect the recreational investment. Percentagewise, funds available in 1952 for maintenance provide about one-half percent of the replacement value of these forest recreational facilities. This is a ridiculous way of protecting an investment.

The preceding situation applies to such recreational uses as camping, picnicking, winter sports activity and such. Another tremendous use of the national forests is represented by its wildlife populations.

Appropriations provide $140,000 for the Wildlife Management Division of the Forest Service. This is enough to cover the salaries and expenses of wildlife men in Washington, and of one man in each of the nine regional offices. With such a niggardly amount we must meet the task of administering, managing and maintaining the national forest wildlife assets. What are these assets? One third of the country's big game animals, including deer, elk, moose, bighorn sheep, mountain goat and bear are resident in national forests. These areas are host, also, to many other species of birds and mammals classed as game, and to many non-game species, both common and rare.

Within the national forests are 81,000 miles of fishing streams, 635,000 acres of reservoirs, 1,500,000 acres of natural lakes and ponds. Some three and one-half million fishermen and about two million hunters annually use the national forest for this type of recreation. Proper management of this resource calls for modern management practices in respect to water, planting, food and cover. Not a nickel is available for this. Administration also calls for coordination between management of timber, range and other areas so that the habitat for fish and wildlife may be maintained. even improved, This now must be done through the inadequate means of one specialist in each region.

We have been thus statistical in order that we may present a picture of the short-sighted manner in which we are protecting our recreational investment in the national forests — both the investment man has made and that handed to us on a silver platter by Nature.

What, then, is the answer? Pending in the Congress, and pigeonholed by the House Agricultural Committee, is H.R. 565, introduced by Congressman Tackett of Arkansas. This bill provides that ten percent of the income derived from the national forests be set aside for the management and improvement of these recreational resources. Last year these receipts amounted to fifty-five million dollars, and went into the general treasury. Ten percent would provide, therefore, some five and one-half million dollars. This is, perhaps, more than is needed at the moment, and more than might effectively be used under present administrative conditions. But it is obvious that at least three and one-half millions are desperately needed to do the job confronting the Service and to protect our investment as a people.

We understand that an alternative proposal has been discussed, under which a recreational use tax, or stamp, or license would be issued to those camping or otherwise using the national forest facilities. This may be translated into proposed legislation, and might well be considered at the same time as the pending Tackett Bill.

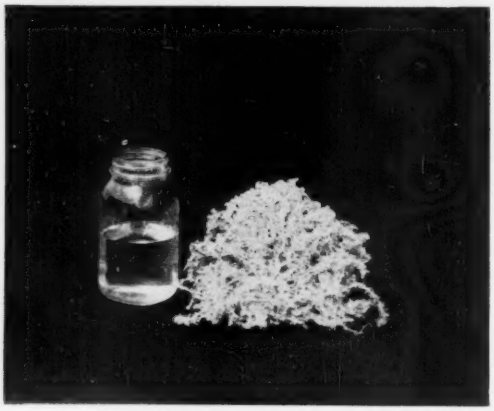
In our opinion, however, it is important that H.R. 565 be taken out of its pigeonhole and given full and considered hearing. If we cannot by present methods get adequate appropriations to protect our investment in national forest recreation, and to assure badly needed expansion of existing facilities, then the Tackett Bill offers the logical answer.

Sphagnum Moss Goes Modern

By WILLIAM GILMAN

Photographs by Eleanor Gilman

THERE are pioneers in the green world too, and, like humans, they are not always fully appreciated in their lifetimes. Until recently, one could use peculiar sphagnum moss as an example. But this ancient and thirsty plant has begun to enjoy popularity. Expert horticulturist and amateur gardener are praising sphagnum's "living sponge" superiority over



The clump of sphagnum has been dried, but retains its original structure. It will absorb all the water.

soil as stuff in which to sprout seeds of any kind.

Ages ago, sphagnum was filling many a dank morass and shallow pond with the buried remains of its long, leafy stems. This helped build the world we know, by providing footing for the land animals and less soggy plants that followed.

Man early found use for the deposits of sphagnum, which had become packed and partly decomposed under conditions of much wetness and little oxygen. Calling it peat, he dug the stuff, and dried and burned it as fuel. Or, calling it peat moss, he used it as a superb soil conditioner for gardens.

In other words, sphagnum was worth more as peat, when long dead and buried, than when alive.

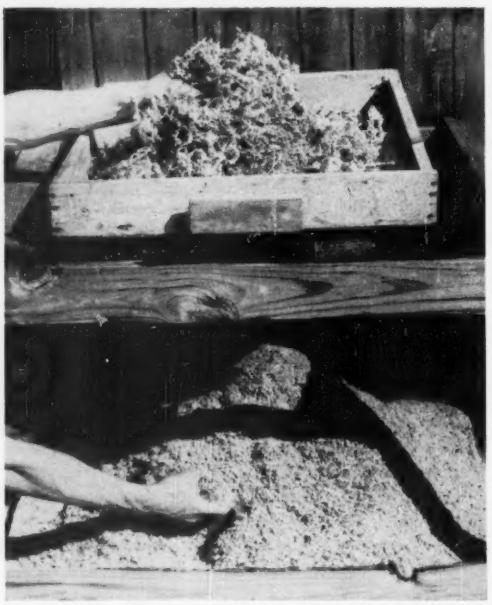
But the story is more than one of requiem and exhumation. In the centuries that peat has been dug, sphagnum has continued to grow — a pioneer not yet crowded out of existence. It still throws its deep, straw-colored carpet, tufted with green, across quagmires and its remarkable water-holding traits have not changed.

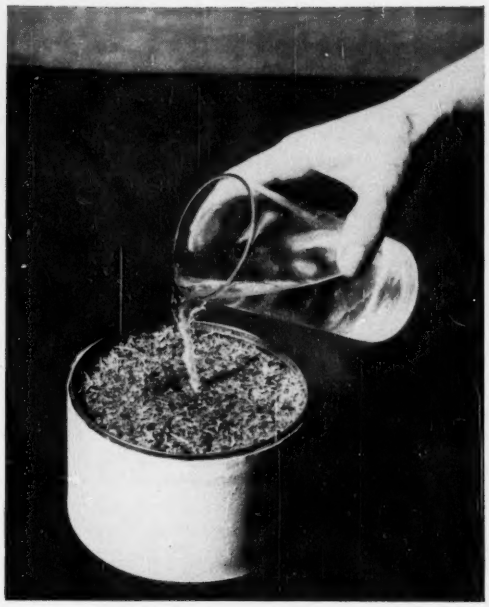
Arctic natives once baked it into a sort of bread, neither very nutritious nor tasty, but sphagnum's chief

This living sphagnum has just been pulled up from a marsh and reveals the structure of its long, lacy stems.

helpfulness has been as a unique sponge. In our era of the old opera house and gas-lit elegance, it served as packing to keep hanging floral decorations alive, and it is still used by wreath-makers. Nurseries have long shredded it and mixed it with soil for rooting cuttings, and could hardly do without it as a wet blanket in which to wrap the roots of young plants for shipment. Its value as a soil mulch is obvious. And your old-fashioned fisherman knows no better way to keep his supply of nightcrawlers content than to carry them in a can filled with moistened sphagnum.

The dried, raw moss is shredded and sifted by rubbing over hardware cloth. Smaller quantities may be handled by tacking the cloth to a cigar box or similar box.



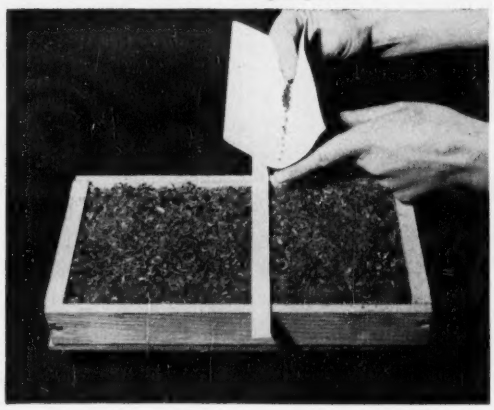


Whatever the container, it is packed with moss, watered and seeds are dropped on it. Allow drainage of surplus water.

Until recently, however, few realized that this kind of moss could serve as a remarkable wet nurse for propagating plants. When dried and shredded, it is a nearly perfect soil in which to germinate seeds. Its cleanliness and inexpensiveness are incidental. Sphagnum's main value is in providing a happy medium; it reduces the labor and worry involved in watering neither too little nor too much. Striking that nice balance is the first requisite of having a "green thumb."

Without sufficient moisture, a seed will not sprout and grow. But gardeners also know how disastrous excess wetness can be in the seedflat filled with ordinary soil. "Damping off" can strike seedlings just before they emerge, and is most discouraging when it attacks a few days later. For no visible reason, the young stems shrivel, the seedlings collapse and die. An assortment of "damping off" fungi are to blame, and they can murder every seedling within reach.

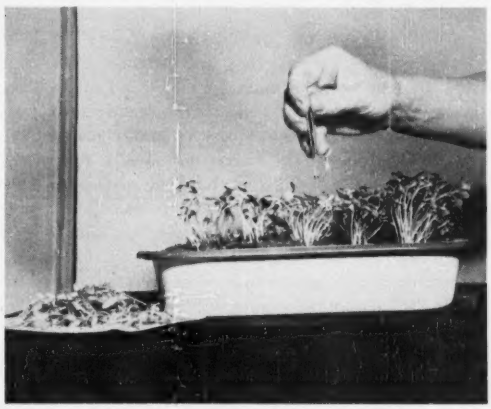
Sowing is simple. Here cabbage seeds are being dropped atop the seed bed. They need not be covered with sphagnum.



Since the fungi thrive in wet soil, light watering is one way to control them, but if seedlings are to prosper, this means they must be visited every few hours with the sprinkling can. Another control, also bothersome, is sterilizing the soil, either by baking it before planting, or treating it with a chemical like formaldehyde.

To avoid all such fuss and muss, certain substitutes for soil can be used. They should be sterile and hold considerable water. A seedbed of peat moss is effective. So is one of vermiculite — mineral mica that has been expanded by heat in somewhat the way corn is popped.

But sphagnum is less expensive than vermiculite, and soaks up water easier than does peat moss, which "drinks" slowly. Moreover, sphagnum's quantitative thirst is phenomenal. My own tests, using materials without special pre-drying, showed sphagnum holding



Seeds in sphagnum yield heavily and thinning out is necessary. Here are marigold, zinnia, tomato, cauliflower and cabbage.

seventeen times its weight in water. The other two media held around five times their weight.

Besides this, there is the almost magical insurance against "damping off," and the laziest gardener could not complain of the work involved. It is not even necessary to cover the seeds. They are simply dropped atop the bed of soaked sphagnum. After sprouting, their downward probing roots do the rest. If you use tested seed which certifies, say, 95 percent germination, then you may count on just about 95 seedlings from 100 seeds. The only drawback becomes "thinning out" labor, and you will use fewer seeds, a second time.

The secret of sphagnum's success is not yet clearly understood. Why can it gulp and hold prodigous

amounts of water, yet not tolerate presence of the terrible little fungi?

Besides storing worms in wet sphagnum, your angler has other use for it. If a fishhook tears his finger, he wraps the wound with the moss, which not only has a soothing coolness but has been credited with "antiseptic" value. And, a century ago, encyclopedists were referring to the antiseptic qualities of peat, of which sphagnum is parent.

Such words as antiseptic, and, more recently, antibiotic, are frequently used loosely to cover various types of inhospitality, not well understood, to disease organisms. At any rate, whether the germ foe is slain, suffocated or starved, an antibiotic like penicillin is wonderfully effective. Here a fungus produces a substance to defeat bacteria, which are of a lower order. Can it be that sphagnum acts similarly against fungi? After all, the spore-reproductive mosses are also primitives, not much higher above fungi in the plant world than fungi are above bacteria.

All this is simply theorizing. It is safer to consider sphagnum simply as a sterile medium. It decomposes extremely slowly, so offers scant nourishment for fungi. Moreover, although "damping off" is associated with excess humidity, sphagnum's wetness is an open, ventilated type more like that of sand. This can be seen quickly when using sphagnum for seed sprouting. Those who garden delicately are charmed by the fact that it does not soil one's hands — no mud! The meshwork of capillary cells in the leaves and stems swell with water. Any excess is simply drained off. It quickly dries on the fingers and can be flicked off.

As a wet nurse, sphagnum has long performed basic tasks. All of the mosses are pioneers. Some cling precariously to rock, living on a slim diet that is little more than the dust, fog and dew they capture, in turn becoming humus upon which more civilized plants can feed. Sphagnum, occurring in about 200 species, prefers the bogs of northern climates.

Wander into a low place, perhaps one with a clay bottom that makes for poor drainage. Your eyes may have been caught by something more colorful — swamp pink, marsh marigold, or cat-tails. At their feet, if conditions are right, you can find a carpet or hummocks of sphagnum.

Part the fluffy stems and see how it has been lifting itself by its bootstraps. The perennial keeps growing at the top of its stem. The lower end is continually dying away, to become peat in due time. Various types of vegetation produce peat, which can eventually become lignite and coal. The purest horticultural type of peat moss is derived from sphagnum deposits.

The moss is a little fantastic in the way it absorbs rain, dew and fog. Some horror stories about quagmires involve sphagnum and its peat bogs. There have been sinister, "highmoor" types in which the growing sphagnum actually lifts the water level above that of surrounding countryside. In Ireland, bursting bogs have been calamitous. With the moss carpet stifling evaporation, the raised bog swells with rain; when it eventually lets go, a deluge can pour down on lower land.

America's sphagnum bogs have been better behaved. The moss is regularly harvested in such States as Wisconsin and New Jersey, put through a drying process and sold in bales. Most nurseries, or the local florist, use it for packing and have it for sale.

My own supply came from a pasture marsh on my Vermont farm. Leaving it under the sun a couple of days dries it. Rubbing the dried moss over hardware cloth quickly shreds it, producing the sifted sphagnum so useful for germinating seeds.

The ordinary seed flat, or even a shallow dish, can be used in preparing the seedbed. By slightly moistening the sphagnum first, it will pack better. Then it is thoroughly soaked, given a slight top layer of additional sphagnum, sprinkled and ready for sowing. The technique was evolved by V. T. Stoutemyer, Albert W. Close and Claude Hope, horticulturists of the U. S. Department of Agriculture, and anyone wishing to use it should get full details by writing the Superintendent of Documents, Washington 25, D. C., enclosing five cents for a copy of Leaflet No. 243 entitled "Sphagnum Moss for Seed Germination."

Government scientists at the U. S. Plant Introduction Garden, say the method is elastic enough to meet any needs. They have used it to germinate seeds of several thousand species of plants from both tropical and temperate regions — not only vegetables, but also azaleas, conifers, herbaceous perennials, annual flowering plants, palms, cacti, succulents.

My own experience through several years shows that the moss easily lives up to promises. I have used it for a variety of standard vegetable and flower transplants; also on trickier things, like cucumbers and melons, by using a band with rich soil topped with a layer of sphagnum for sprouting and mulch. The moss is also ideal for hurrying such things as sweet corn and lima beans, which just lie in the soil and rot if planted directly in the garden during a cold, wet spring. First getting their roots started on wet sphagnum, then transplanting, saves both seed and reseeding labor, and gives such garden produce earlier.

There are several other advantages. There is no need for daily watering. After soaking the seedbed, planting and covering it, it can be forgotten for a week. There is no need to sterilize soil or worry about over-watering. Sowing is simply a matter of dropping seeds atop the moss. If the supply is limited, one can use soil covered with an inch top layer of sphagnum to do the sprouting job.

Root systems develop more uniformly in the moss. When transplanting, seedlings come out of the moss bed without losing part of their valuable roots. Some moss clings to them. This keeps them from drying during handling.

There is also the valuable feature of being able to "store" seedlings for later use (Continued on page 162)

In ranks, the warriors of Queen Polyergus march across on a slave-hunting raid upon a colony of peaceful ants.

Queen Polyergus and Her Slaves

By ROSS ELLIOTT HUTCHINS

THERE is drama under your feet! If you doubt this then come with me to the open field of Luxapililla Pond and see a real life drama as poignant, in its small way, as any in human affairs.

The field where I take you is an open meadow. In summer, tall grasses wave in the breeze, bees buzz among wild flowers, and cows graze in bovine tranquillity. It seems like just any summer day, but to the queen *Polyergus* ant it is very special, for it is her wedding day. Early this morning she emerged from the underground colony clothed with gauzy wings and took off upon her marriage flight, followed by many males. She flew faster than the drone ants but eventually she was overtaken by the fastest of her suitors, and mating took place upon the leaf of a sweetgum tree.

The honeymoon was short, and now she has forgotten her mate, has shed her wings, and is searching among the grasses for an ant colony. She is large for an ant, and moves rapidly and boldly in her quest. After several hours she locates an ant colony that has a small heap of earth thrown up at one side of the entrance tunnel that leads underground. Strangely, the small ants that occupy this nest are a different species from the queen ant, and they become much agitated upon her approach and attempt to attack her. But she seizes one in her powerful mandibles and tosses it aside, and disposes of another of the small black ants by severing its head from its body. Quickly she enters the foreign colony and descends several floor levels to the chambers that are used as nurseries. Several times she is challenged by the inhabitants, but she brushes them aside. In the nursery Queen Polyergus becomes much excited and engages in a prancing dance about the chamber, but she wastes little time, for, as the saying goes, there is "dirty work afoot."

The chambers of the nest are completely dark as only a cave can be dark. Not a ray of light penetrates the ink-black realm, but she has other senses that guide her just as surely as if electric lights were present.

First Queen Polyergus explores the passages until she has found an empty chamber that meets all the requirements of Her Highness. Not just any chamber will do, for royalty can be choosy, and she is, after all, not just any queen. After she has settled upon a certain

chamber she then returns to a nursery chamber and begins the task of carrying ant cocoons away. These she stacks in a neat pile in the chamber she has selected. Now and then a worker ant darts at her and attempts to rescue one of the cocoons, but she quickly dispatches it with her savage jaws. When she has about thirty cocoons stacked up she rests from her labors and settles down to guard the loot.

Queen Polyergus is really, as you may have guessed, a Fifth Columnist; but she has a technique that far surpasses that of her human counterparts. After all, her technique should be good, it has taken two or three million years for her ancestors to perfect it. The cocoons she has stolen contain the young of the rightful owners of the ant colony. Out of these cocoons, within a few days, will emerge young worker ants ready to take up their duties in the daily routine of the colony. The Queen watches these cocoons carefully, and when she determines that the young within are ready to emerge, she gnaws away the tough, outer covering and liberates each white, juvenile ant.

Now, just as ducks may be reared by a hen, so these young are reared and schooled by the foreign queen. They become such loyal subjects, in fact, that they will defend the foreign queen against their own kind, thus Queen Polyergus finds herself surrounded by a corps of subjects ready to serve her. Her "beach-head," so to speak, is now established and she is ready to achieve the next stage of her "Fifth Column" campaign.

She must now seek out and destroy the rightful queen of the castle that she has invaded. This she does quickly and with characteristic efficiency, and for all practical purposes the city may be considered to be "sacked" and the resistance of the inhabitants ceases.

But a strange change comes over Queen Polyergus now, and she becomes a timid and retiring ruler, never venturing beyond the confines of her chamber. Here, while flowers nod in the hot sunshine in the green world above the ground, she becomes a recluse. Her traveling days are over and her only function is now the laying of eggs. She has slave ants to carry out her every need; to obtain food, to rear her young, which in time will form a great, savage, horde of slave-capturing warriors. In fact, she becomes so completely dependent upon the slaves that she could not care for herself or her young, even if she wished.

Time passes and the flowers of spring make way for the steamy days of midsummer when vegetation wilts under the harsh caress of the winds from across the hot land. Queen Polyergus is now surrounded by many hundreds of warriors of her own kind. They are strong and aggressive and completely dominant over the slaves, which are smaller in size and black in color. Strangely, these slaves have, to a certain extent, taken on the aggressive characteristics of their masters, and often go upon slave hunting raids with them. The workers of this master race are extremely pugnacious, and their slender, sickle-shaped jaws are not fitted for such labor as digging in the earth or caring for young, but they are admirably adapted to fighting and the piercing of the tough armor of other ants.

Now, not far from the bank of Luxapililla Pond and about a hundred yards from the nest now belonging to Queen Polyergus by right of conquest, there dwells a peaceful colony of ants. Like many a peace-loving nation of humans, they gather their food where they find it, rear their young, and live with their neighbors.

For some time now Queen Polyergus and her warriors have needed more slaves to do the work of the castle, and scouting parties have been sent out to look for likely ant colonies to plunder. The peaceful colony by the pond was soon discovered, and soon other scouting parties were sent out to further "case the job," to use an underworld term.

Soon there is seething activity among the warriors of Queen Polyergus. Nervous tension runs high, and this in turn is taken up by the slaves. At last, one day, the lust to do battle reaches its climax and warriors by the hundreds pour from the nest entrance. There is great confusion. Some of the slaves, perhaps realizing that the raid is aimed at their own kind, attempt to hold back the frenzied warriors. Other slaves join in the expedition along with their masters.

The seething horde pours over the ground with feverish haste, and little time is wasted in lost motion. Scouting parties have learned the route to be traveled and the advancing column moves at the rate of an inch a second. Now there is little confusion, the ranks of warriors move in a solid stream and soon they reach the objective. The colony under attack has had no warning, and there is little or no attempt at defense. The warriors pour without hesitation into the peaceful colony and begin the work of plunder. Soon there is a host of warriors emerging from the nest, each with a young ant in its jaws. By now the defenders have gone into hiding or have climbed up on the surrounding vegetation to safety. Here, as always in Nature, victory has gone to the strong.

Now the long column of the raiders of Queen Polyergus returns to its castle with the booty — cocoons and young slave ants. Travel is slower now; no longer is there the feverish haste. The climax is over. Tonight there will be feasting at the castle because only a portion of the young ants are reared to be slaves.

To the victors belong the spoils of war, just as it always has, from Kubla Khan to Queen Polyergus.

At the Grand Canyon

By EDWARD McNAMEE

When first I stood
Transfigured there,
My soul released
A fervent prayer.

And this thought rode
The purple mists, —
Oh what a sight
For atheists!

Ferns Here and There

By LESTER ROWNTREE

IT WAS at the end of day's fern collecting with my father in the English Lake District when, as a small girl, I made up my mind that, as soon as I was free of schools, I would spend all my time hunting ferns. Things did not turn out just that way, although a few years later I was searching for ferns in California, and, later, in many other States. After an interim of intense domesticity came the period of wild flower seed collecting — and with wild flowers grow ferns.

In the West, it is easy to let ferns arrange themselves into three groups, the ferns of high mountains, those in the deserts of the Southwest, and the ferns that grow in the shade and rich humus offered by the coast redwoods of northern California. Between these groups are many other ferns scattered throughout the foothills and lower mountains of the western States and Mexico, and among these are the licorice fern, the popular and much loved coffee ferns, birdsfoot ferns, and the gold-backed and maidenhair ferns.

The fern season really opens with the moss ferns, selaginellas, botanically not ferns at all but closely related. The heavily commercialized resurrection plant of Texas, Mexico and South America is a large selaginella. It clings to rocks — sometimes to dry bare slopes — and during its rest period it, like all the selaginellas, looks like a crumbly bit of vegetation, apparently quite lifeless. When the rainy season comes and a few drops have fallen on the short, slender branches that are coiled like tiny brown ostrich feathers, a miracle happens, the plumes unfurl and reveal their smooth surfaces of rich green.

A small terrace, originally planted to an alpine meadow, ties my study to the edge of a tiny canyon. Across the steep far side of the canyon spreads a fast-growing colony of licorice fern. All through the summer's drought not a fern frond is in sight, and the stony slope is a jumble of wild cucumber, morning glory, and other late-flowering natives. But after the first good rain, from my study door — wide open to let in the sun — I can watch the bank come to life. So swiftly do the small green curls straighten that the canyon side is green before the deciduous maidenhair at its base has thought of beginning to reappear. Licorice fern, or polypody, belongs to a large and widespread genus. The eastern species line the tops and upper shelves of dry rocks, and the thick leathery fronds stay green all winter.

Much of the charm of the coffee ferns and the birdsfoot is in the steel-blue shade of new fronds. The leaflets of the latter are divided into three, close to the mahogany stem and really do look like the feet of

Among the redwoods of the coast many varieties of ferns grow in the rich humus or find lodgement on fallen logs.

birds. There are some stunning colonies of coffee fern in the lower mountains of California, southern Oregon and northern Baja California. The gallant battalions strike boldly up steep, shaly mountain sides. Often the fronds are wind shorn into the same curve and all lean up-mountain in a gray-blue mass, accompanied, perhaps, by drying grasses, which seem to be hurrying the procession upward.

It is July before snow recedes far enough for the field worker to reach the alpine ferns. The fragrant mass of chaparral is penetrated and left behind, and the forests of conifers, heavy with the scent of mountain misery, are entered. Here sun on damp needles loosens sweet aromas. Fir and pine announce warm weather by ringing lake and pool with yellow pollen and scattering the fine gold dust over ground and branch and blade. Then come flower-filled mountain meadows where swift streams cut their way through thick turf, and the feathery seeds of prostrate willow cling to the naked body as it emerges, all dripping from river or lake. From this point the swirls of bare granite above glisten silver-white, and the face of the mountain range is creased and serrated until it disappears under its crown of snow. In this enchanting zone the fern addict finds plenty to keep him amused. In one section of the central Sierra seven small, chink-dwelling fern species can be found within one-sixth of a mile of one

another. The altitude is from nine thousand feet up, and the region abounds in the choice alpines of the Hudsonian and Boreal life zones.

These little ferns may follow a perpendicular crack, or wedge their way along the base of an immense glacier-polished boulder perched atop another rock-drop, or they may lead contented lives in the tightly packed gravel and humus that has lodged in leveler places. All relish close quarters where their roots are moist and where, for at least nine months of the year, the sun strikes their fronds for a short time on each fine day. During August and September the run-off from snowbanks slackens and all Sierran plants not inhabiting year-round damp meadows seem to accept and find pleasure in a semi-drying-off process. Although they live

These high crags above Bishop Pass in the high Sierra provide home for many interesting ferns, while the bare looking desert and desert mountains boast their varieties also.

in crowded quarters they are not averse to interlopers. Mountain bulbs may be pegged down among the fern roots, and the starry flowers of alliums, of cornyellow *Brodiaea lugens*, and the larger bloom of the high mountain mariposa, dark-eyed and golden-blotched, may appear among the fronds.

Four cliff brakes are included in this little assemblage of ferns, three of them looking much alike, all having shiny, dark red-brown stems and leaden-green leaflets, which feel like bits of thin leather. The leaflets of Bridges cliff brake and compact pallaea are folded back and arranged like pairs of steps going up each side of the five-inch stalks. The steps on Brewer's pellaea are divided part of the way, giving the effect of twin leaves. Oregon cliff brake is a very different looking affair. Its stem is the same glistening mahogany, but the fronds follow a triangular pattern and each division of narrow, dark-green leaflets tapers off to a pointed tip. Rock brake belongs to a different genus and grows also in the Coast Ranges. It carries two kinds of fronds. The green-stemmed eight-inch fertile fronds, leaflets tightly folded, rise triumphantly above the lighter green sterile fronds, whose wider leaflets look more relaxed and are the exact pattern of a lace that our grandmothers used to wear.

Although sky and cloud miracles are constantly happening on the desert — and no charge made — although the steep sides of narrow canyons in desert mountains are curtained with wild flowers marching up to meet the shadow-casting clouds, and the amber desert floor may be hidden from view by miles of solid bloom, one does not think of this sun-baked land as being the home of ferns. And yet, wedged into rocky crevices, or lining the foothold of boulders in the Panamints and other desert mountain ranges of the Southwest, and going far down into Baja California, are tiny desert ferns of exquisite beauty. Like most plants of dry hot places, desert ferns resort to covering themselves with some sort of a protective coat — wax, hairs, cotton or wool. The under sides of pigmy fern are light yellow or white with waxy powder, cotton fern wears a coat of close felt, and Parry cloak-fern a woolly one of red-brown scales. Some of the lip ferns grow only on desert mountains, while Coville's lip-fern overlaps other mountain ranges and is also a Sierra fern. This is a most individual four-inch plant with fronds made up of hundreds of tiny leaflets feathered at the back with silvery scales, which are at their thickest and whitest where the climate is hottest and driest. Sometimes as many as five mountain fern species may be found under one huge boulder, and in one of my pet desert haunts a twenty-nine-foot ribbon of Coville's lip-fern decorates the north side base of a monolith the size of a huge house. The thread is a foot through, its fronds all facing the light, but leaning backward toward the blackness in the rear. This intrepid flow maintains its dark, erect bearing through drought (Continued on page 161)

You taught my ear to hear, my eyes to see
And heart to thrill me — joy can never fail
If one has beauty's wealth divinely free!
A thousand priceless gifts of vision clear!
My heart bestows its thanks, my mother dear.
—Esther Lloyd Hagg

Often we stopped at parking areas to view the majestic peaks.

NATIONAL PARK SERVICE PHOTOGRAPHS

Thanks to A Beauty-Loving Mother

By CHARLOTTE HILTON GREEN

How much richer life could be for children, parents, teachers, if all could be brought to realize that almost all of us have much of beauty's wealth "divinely free."

Children, in particular, can avoid much of loneliness, of fear, of restlessness and boredom, if both parents and teachers train them to have "ears that hear and eyes that see and a heart that thrills to beauty."

On a trip to the "top of the world," up above timberline in Rocky Mountain National Park, I had the opportunity to observe two sets of mothers with their children. At various points on the long way to Trail Ridge Drive, our cars, and many others, had stopped at the same parking areas for views, and also at the Park museum.

One car next to ours contained a boy and girl, a mother, and evidently a visiting aunt, who was being shown the park, to the boredom and discontent of the children. "Aw, let's go, we wanna get back to the comics an' our firecrackers. Let's go home. Jimmy'll have his all shot off while we're pokin' around up here."

His mother tried to hush him up. "Be quiet, Tommy. I told you we were coming up here with Aunt Ellen. *Stop your fussing.* We are *not* going back yet. Come into the museum."

The other mother was already showing a small daughter the mounted specimens and the habitat groups of the birds and mammals they might see. The ptarmigan, in particular, fascinated the child, for the mother had pointed it out in its white plumage of winter where, against the snow, it was inconspicuous and thus safer from its enemies. Again, she explained how it would look in mottled-brown plumage of summer, when it blends into the lichen-covered rocks among which it lives, and so again is inconspicuous and thus safer.

As we left the building I heard the first mother threatening the boy and girl with "no supper, and no fireworks, if you don't stop this fussing."

Again our several cars stopped at another parking area — Many Parks Curve — where there was a wonderful view, and where the typical birds, the Rocky Mountain jay and the Clark nutcracker, were to be seen, and where two or three kinds of chipmunks and ground squirrels were so tame they would come and feed from the hand. A bag of peanuts to feed the small animals kept the boy and girl amused for a few moments, and, apparently with this hopeful sign, I heard their mother bribing them with the promise of a dollar each if only they would be good children and "let Aunt Ellen enjoy the trip." But she did not bother to see that the children learned anything about the animals, or about the distant mountain peaks.

The other mother and child were eagerly listening to a teacher and her group of campers. The leader seemed to know the region well and was telling her campers what the various peaks were, something about the glaciers they would see, and what the nearby trees and flowers were.

Still later, up above timberline, we saw mother and daughter and teacher and campers again. They had all become friends and were having a wonderful time with the Alpine flowers. (I shamelessly tried the writer's trick of keeping close and eavesdropping.)

"You see," she explained, "whether we go north or just go up, up, up, it gets cold just the same, so that is why these plants are something like those of the Canadian tundra, or the Alps. Such plants are often called 'Alpine flowers'." And she told how this Alpine life zone, or any Alpine life zone, comprises a distinctive world of dwarfed forms of plants on the rolling mountain tops and tundras.

With a shriek of delight the children found the tiny Alpine mertensia (back East we call its larger form Virginia bluebell) about two inches in height, yet complete with stems, leaves, flowers. It was just like the one in their garden, Muriel exclaimed, except theirs was more than two feet tall. They found and identified Alpine buttercups, Alpine forgetmenots, Alpine clematis, and clovers and pinks.

Ground squirrels were friendly and unafraid and won everyone's heart.

And how those children loved to say "Alpine this" or Alpine that!" It was a new word, and like all children, they were extracting the utmost satisfaction out of using it, for children love new and grand-sounding words. But now the teacher and her campers had to start back to camp, and we all parted with regret. Apparently we had lost the car with the bored boy and girl, so we never knew whether or not they had won out and returned home early to the "comics and the fireworks."

By this time I was so fascinated with Muriel and her mother that I urged my hosts to linger until they, too, were ready to leave. And so, later, when we reached "Rock Cut" we all climbed Monument Ridge together to look for those much-sought-after ptarmigans. We followed the rock cairns laid out by the park naturalists under the auspices and direction of an ancient Indian, who had remembered the old trails his people had used when they crossed the mountains.

At this high altitude above Rock Cut we had to stop often to rest, for the elevation was more than 12,110 feet. Up there, on the top of the world, we could look out over range upon range of mountains, with their glaciers and snow-mantled peaks. There was beauty everywhere, and a wise mother had trained her daughter to be receptive to it. Her ears had also been taught to hear, for suddenly upon the quiet of that high place we heard the shrill cry of the cony, a little rabbit-colored rodent, smaller, but shaped something like a guinea pig. Probably we would not have seen him, so protectively colored was he — as Muriel's mother pointed out — but his shrill squeak gave him away. And there he was, sitting between the lichen-covered rocks, blending perfectly into his background.

They had remembered seeing the habitat group of the cony in the Park museum, and so began looking for the little store of "hay," dried grasses and flower stems, which this tiny fellow gathers for the lean days to come. Thus he is able to be active over much of the winter, when the less provident chipmunks and ground squirrels must hibernate.

We did find one of those small piles, and I told them the story of a similar relative called "whistling hare," which lives on the steppes of Mongolia. There they live in large colonies and store up such quantities of hay near the openings of their holes that sometimes the lazy Mongols bring their cattle to feed upon these stores, instead of bothering to gather fodder themselves.

My party had to leave before they did. We had not found the ptarmigan, so I left them with the hope of "good hunting" and the wish in my heart that such a "beauty-loving mother" could be duplicated all over the land.

On another trip to the high places that summer there was the child in the party who was terrified of the heights, and hair-pin curves and yawning chasms, so much so that finally she slid down to the floor of the car and would not look out. Yet it took such a little thing to arouse her interest in her surroundings and alleviate her fear! Very casually I suggested that she and I ride in the same car, and on the same side, and see which of us would first spot a water ouzel.

The strange name aroused her curiosity. She began to forget her fears at hearing about the small gray bird that not only likes tumbling, rushing streams, but can even walk on the bottom, looking for insects; that can

actually fly under water, and that sometimes builds its nest behind a waterfall, seeming to *like* going through a curtain of falling water or spray.

Birds were rather an unknown world to this child, but that tale of the ouzel so intrigued her that fear of space and heights was overcome by her newborn curiosity and interest. So intent did she become in the search — and to be the first one to see the bird — that before the trip was over she had to be cautioned not to lean out the car window *quite so far!* After a few miles some one did shout "water ouzel" and we stopped. All piled out of the car and the child had the opportunity of watching the bird for a long time. She saw it do the very things I had told her, all except flying behind a waterfall, for there was none in that particular stretch of the South Saint Vrain River.

After that, on this particular trip at least, her fears of great heights and depths was overcome. She was too busy watching for another water ouzel along the stream, and for bighorn sheep on the dizzying heights above.

Nor should the beauty of the skies be overlooked. "For showing me 'the diamond in the sky' and 'silver moon-boats, sailing calm and high'" are other lines of the poem that heads this article. I know one child whose fear of being out alone at night was overcome by a little judicious teaching of the stars, tied up with the lines of the 8th Psalm: "When I consider thy heavens, the work of thy fingers, the moon and the stars—." It seemed to give him a sense of comfort of the nearness and protectiveness of God. Too, it helped him to know he could always get his bearings by finding and facing the North Star.

Flowering raspberry often grew in profusion. The wild flowers were something "out of this world" in those mountain regions.

At 4-H Camps where, at their annual wildlife conference in my State I had worked for years with these boys and girls in a Nature Activities program, I always planned to have one or more "Evening with the Stars." This was a brief session, fifteen or twenty minutes, a refreshing interval between inside programs and later games and square and folk dancing. We would go out to a high hill in an open space above the camp, and, with a strong flashlight, I would point out a few of the stars and constellations. Always, to orient ourselves, we began with the Big and the Little Dippers. Children are quick to catch on to "the pointers," those two stars in the outer side of the bowl of the Big Dipper that point directly to the big star in the end of the handle of the Little Dipper, which is the Pole, or North Star. Immediately they see that, facing it, they are facing north.

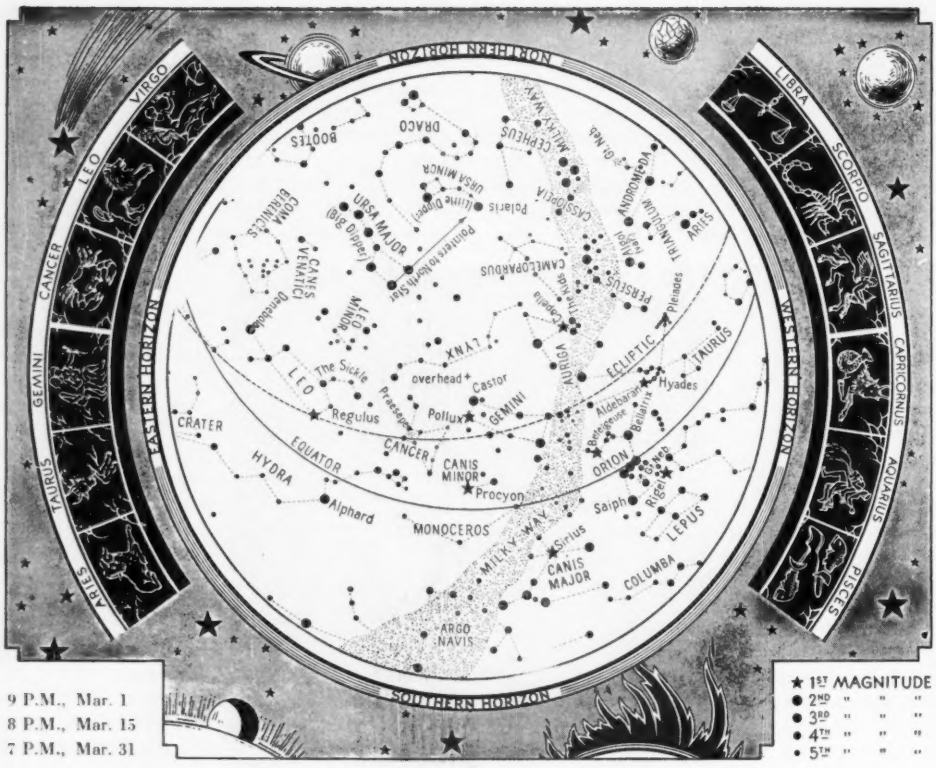
Nor have I ever had a group of children that did not enjoy the story of the "test star," *Alcor*, the tiny companion star to *Mizar*, which is the star that is second from end star in the handle of the Big Dipper. Seemingly very tiny and hard to see, they like the tale of how the ancients, who studied the stars as they watched their flocks by night in the far-off Bible Lands — and who named so many of our stars and constellations — believed that to be able to see this small companion star was a "test" of good eyesight. And so they called it the "test star."

But the children liked even better the American Indian name of "Squaw and Papoose" for these two stars, for the Indians thought that the little star resembled a papoose riding on its mother's back!

Beauty and interest, and a sense of awe and sublimity and a feeling of being at peace with the night, should be every child's heritage, and can be given him with only a brief acquaintance with the skies. What a pity for any child to grow up and not feel a sense of beauty and reverence when he sees the silvery crescent of the new moon. How much would we miss if we lived in a world that had no moon!

How much there is that is "divinely free!" Almost everywhere we go, unless it is city slums or drab industrial areas, there is some natural beauty about us. Birds, flowers, trees, sunrises, sunsets, mountains, hills and valleys, streams and pastures with cattle grazing. Teach children not only to see beauty, but deliberately to seek it, and to pass it on to others less observant.

I have heard that great teacher, the "Mother of the Nature-Study Movement," Anna Botsford Comstock, tell how she literally absorbed beauty at her mother's knee. Her people were Quakers of the old school, and at that time music and singing were among the "must nots" of that creed. So, as (Continued on page 161)



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

Signs of Spring in the Sky

By ISABEL M. LEWIS

SPRING begins in the northern hemisphere, and autumn in the southern hemisphere, when the sun is at the vernal equinox. This is one of the two points of intersection of the celestial equator, lying directly above the earth's equator, and the ecliptic, the apparent yearly path of the sun through the heavens. The autumnal equinox, through which the sun passes six months later, is the other point.

Spring will begin this year in the northern hemisphere on March 20 at 16 hrs., 14 mins., Universal Time, or Greenwich Civil Time. This corresponds in Eastern Standard Time to March 20, 11:14 A.M. In certain longitudes it will, of course, fall on March 21. The time when spring begins may vary by a number of hours in different years. Leap year has its effect in determining the exact time, and there are other causes — producing some irregularities in the motion of the earth in its orbit and thus the apparent motion of the sun — that have their effect upon the time when the sun is on the equator. In general, however, one may say that spring begins either on March 20 or March 21.

When spring begins the sun rises at the east point of the horizon in all latitudes and sets at the west point. It is also directly in the zenith at a point on the equator whose longitude is determined by the time when the sun is on the equator. The beginning of spring is a definite instant of time. After passing through the vernal equinox the sun rises north of east and sets north of west. At the equator the north pole of the heavens lies at the north point of the horizon and the south pole at the south point. The diurnal arcs, or daily paths of objects in the heavens, as seen at the equator, are parallel to the equator and perpendicular to the horizon. As a result all objects in the heavens

are above the horizon at the equator for 12 hours, and below it for 12 hours. So, at the beginning of spring, when the sun is on the equator, the circle that divides day from night passes through the north and south pole. Day and night would then be exactly equal in length were it not for the refraction of light by the earth's atmosphere, which elevates an object above the horizon before it has actually risen, and after it has actually set. It follows that the time that an object is seen above the horizon exceeds the time that is below the horizon in all latitudes, and that the day is always lengthened at the expense of the night.

In spring, when the sun is at the vernal equinox, the ecliptic in mid-latitudes makes its smallest angle with the horizon in the morning sky, and its greatest angle in the evening sky. That is why Mercury is seen to the best advantage in the evening sky at its elongation that comes closest in time to the beginning of spring. This year Mercury will be at greatest eastern elongation on March 18, and around this time should be the best time of year to find and observe this planet in the evening sky. For the same reason, early spring is the best time of year to look for the zodiacal light, which is caused by the reflection of sunlight from particles of meteoric dust that lie in greatest numbers along the ecliptic and inside the earth's orbit, although they extend also beyond it. One should look for this interesting phenomenon directly after sunset in the western sky and along the ecliptic. The zodiacal light is wedge-shaped, with its base on the horizon, where it is brightest and as wide or wider than the Milky Way. It tapers upward along the ecliptic to a distance of about 90 degrees, where it fades out in mid-latitude, although within the tropics it is far more brilliant and may be seen both in the morning and evening sky, extending as a narrow, luminous band completely around the ecliptic. Opposite the sun there is a widening of the zodiacal light into an elliptical spot about equal in size to the area within the bowl of the Big Dipper. This is known as the Gegenschein, or The Counterglow. This is difficult to observe in mid-latitudes. Like the zodiacal band it is seen best in the tropics. One should choose a clear, moonless night to try to observe the zodiacal light in the spring. This would be during the second half of the month in March.

In all latitudes the celestial equator passes through the east and west points of the horizon, but the point where it crosses the meridian depends upon the latitude of the place. At the equator, where the latitude is 0 degrees, an object on the celestial equator passes in its diurnal motion through the east and west points of the horizon and the zenith and has a declination — distance north or south of the equator — equal to 0 degrees. This is the declination of the sun when it is on the celestial equator, at the beginning of spring and again at the beginning of autumn. The range in the declination of the sun is 47 degrees, from 23½ degrees north of the equator, when it is over the Tropic of Cancer, to 23½ degrees south of the equator, when it is over the Tropic of Capricorn. Within the tropics which are defined by these limits, the sun passes through the zenith of all places twice a year, once when it is going northward and again when it is coming southward. At the time of the summer solstice in the northern hemisphere the sun is directly over the Tropic of Cancer, and at the time of the winter solstice it is directly over the Tropic of Capricorn. In the north temperate zone the sun always crosses the meridian south of the zenith, and in the south temperate zone north of the zenith. It can never pass through the zenith of a place that is not within the tropics.

North of the Arctic Circle the phenomenon of the midnight sun occurs when the sun not only crosses the meridian above the pole but also below the pole, or at lower transit of the meridian, when it may be seen either at the north point of the horizon, or at a distance above it that depends upon the distance of the sun north of the equator at the time. The period during which the midnight sun may be seen at any place within the Arctic Circle will begin as soon as the sun's distance north of the equator equals the distance of the place from the north pole, and will continue as long as the sun's distance north of the equator exceeds or equals the distance of the place from the pole. At the north pole all objects above the horizon move around the pole in circles parallel to the horizon, which is the equator. Stars north of the equator never set and stars south of the equator never rise at the north pole. So long as the sun is in the northern hemisphere it is visible at the north pole. This will be for six months from the beginning of spring until the beginning of autumn in the northern hemisphere. During this time, starting from its position on the equator at the beginning of spring, the sun slowly winds its way upward from the horizon until it reaches an altitude above the horizon of 23½ degrees at the time of the summer solstice. It then begins its slow downward path toward the horizon again, which it will reach at the autumnal equinox. For six months there has been a (Continued on page 163)

In Praise of Stars

By CLARA BILLINGS

When Vega comes I know that spring is near,
That fire-blue point, east in the midnight sky;
Or when the frost is sharp and leaves are sere
Orion, shining hunter, meets my eye
Off to the south. Dear to my gaze
And loved as freely as the birds and trees
Are well-known twinkling faces. No faint praise
Can compliment such brilliant friends as these.
Are they not lovely as the flowers of earth
In scintillating white, blue, yellow, red?
And there the mighty Jupiter full-worth
A thousand others lifts his lordly head!
Year after year — uncounted ages gone —
Sky-meadows, come what may, bloom on and on.

The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

WOODY PLANTS IN SCHOOL

ALL OF us have sung of school days, and about teaching to the tune of a hickory stick, but I wonder how many teachers could identify a hickory stick if they saw one in the raw. The special insert in the center of this issue of *Nature Magazine* will not help much because it happens that hickory is not opposite-budded. However, there are various things that can be done in school with opposite-budded, woody plants.

On the first page of the insert we showed you how a horse chestnut twig looks. We chose that because the parts are large and conspicuous, and anyone with the least interest can make the necessary identification. But let us see what we can do with this in the school yard.

In the first place it might be well to identify and mark on a map the opposite-budded, woody plants to be found on the school grounds. In many cases there will be specimens of ashes, maples, viburnums, dogwood, lilacs, snowberry, coralberry, honeysuckle, forsythia, deutzia and other common ornamentals. Once these have been located, identified and mapped satisfactorily, we may be ready to go on for further help. You might send twigs you cannot identify to your State college of agriculture, or maybe send them to me and I will help you if I can.

It may be worth your while to try to get some idea of the age of some of the woody plants on your school or home grounds. To help in that, learn to identify the terminal bud scars shown on the first page of the insert. Then you can determine the age of at least some plants.

Once you have learned how to tell the age of woody plants, through examination of the twigs, all sorts of opportunities offer themselves. Let children find twigs that are as old as *they* are. Let them find the longest twig that is as old as they are, and the shortest twig they can find that is as old as they are. Ash trees may well supply both of these twigs, strange to say. Then extend the story to the history of the school. Take some good old ash twig that has grown slowly but persistently and make a chart showing the years' growths that have some significance in the history of the school, of the community, of the teacher, or even of world affairs. The possibilities of here correlating history and conservation are limitless. It would seem that anyone who, through observation and reasoning, got some valid concept of the length of time necessary to produce a given piece of wood would have some appreciation of values, and of what is back of wood and other resources. This could well be integrated with the material presented in the special insert on wood, which appeared earlier in this series.

Make Demonstrations

Children could make demonstrations showing that they recognize the differences between flower buds and leaf buds, and might well suggest how they could use what they know about these things to manage efficiently the growth of given woody plants. They might draw up suggestions as to when and how the plants of the home or school yard should be trimmed, and how trimming varies greatly, depending on what is wanted of the developing woody plant.

In many cases the twigs of woody plants offer simple disciplines in drawing with some degree of accuracy. These will offer any degree of challenge, from the coarseness to be observed in the twigs of horse-chestnut, catalpa, paulownia and buttonball bush, to the finer details observable only with the help of a magnifying glass in such plants as coralberry.

Exhibits may be presented showing how the growth of different twigs was modified by the amount of room, sunlight, and by other factors affecting development. Charts could be developed and associated with calendars, to show the sequence observed in the flowering of local woody plants. For example, a large wall calendar might have notes on appropriate dates indicating when pupils first observed the flowers of silver maple, red maple, forsythia, lilac, catalpa and so on. Some might like to experiment in speeding up the flowering of some of these plants by bringing twigs indoors in the early part of the season, and thus providing more favorable temperatures for rapid development.

Collections might well be made showing the different ways in which the buds of these woody plants open. Starting with the syringa, whose buds may be completely hidden in the leaf scar early in the season, we will find spectacular development taking place with most of the species covered in the insert.

The changes that take place in the color and nature of the bark of developing woody plants is worth noting and recording. Color, hairiness, the shape of lenticels, or breathing pores, the appearance of cracks, the development of ridges, the evidence of insect injury, the record of flower-bearing, all lend themselves to sensible and profitable observation and report. The variation to be found in the nature of the pith of woody plants, and the definitive differences in the different species, are worth understanding. Many of these are suggested in the illustrations and in the text in the insert.

Some students may become sufficiently interested in this aspect of woody plant study to wish to learn how to use some of the excellent keys that are available for use.

Sources of Information

In my *Fieldbook of Natural History* I tried to present pictures, and a few winter characters, of most of the woody plants given recognition there. There are other books that might be even more helpful, largely because they may have given greater emphasis to the study of the winter condition. Among the useful books in this connection are the following:

Trees in Winter by Albert Francis Blakeslee and Chester D. Jarvis. The Macmillan Company. 1926.

Trees of Northeastern United States, Native and Introduced by H. P. Brown, The Christopher Publishing Company. 1938.

Textbook of Dendrology by William M. Harlow and Ellwood S. Harrar, McGraw-Hill Book Company. 1937.

Keys to Woody Plants by W. C. Muenscher, Comstock Publishing Company. 1946.

Key to Woody Plants in Winter by E. L. Palmer, Slingerland Comstock Company, Ithaca, New York. 1925.

Winter Botany by William Trelease, William Trelease, Urbana, Illinois, 1925.

Plant Materials of Decorative Gardening by William Trelease, William Trelease, Urbana, Illinois. 1926.

The Forest Trees of Ontario by J. H. White, Department of Lands and Forests, Ontario, Canada. 1925.

In addition, there are numerous local books and pamphlets on woody plants, dealing with those most common in given States. Usually if these are available they are available through the State agricultural college, or such institution should be in position to recommend the best reference for efficient local use.

No matter how many books may be available in the library or book store, it will be found that the best reference to the study of buds and opening of buds will be the buds themselves. If you have gone through a spring without observing what happens during this period of development, give the idea a try this year. If you will I am sure that from now on you will look forward to the season as one of the most interesting of the year.

Camera Trails

By

EDNA HOFFMAN EVANS

WISE old Benjamin Franklin once said something to the effect that if you wanted a thing done right you should do it yourself, otherwise you should have someone else do it for you.

Like all generalizations of that sort, old Ben's advice is not always appropriate. For example, if I wanted a new car I certainly would not attempt to put it together myself, nor would I tackle the personal creation of any but the simplest of pinhole cameras. For that matter, I would not care to bake my own bread or fix any of the dozens of food items prepared by someone else that I buy at the grocery store.

On the other hand, there are times when I agree one hundred percent with Benjamin Franklin. Particularly do I agree when it comes to enlarging and printing my own negatives. A commercial developer can turn out a usable print, but his idea of composition and spacing, of balance and proportion, of what to include and where to crop, may not be the same as mine. There are times when I do not know exactly what I want to begin with, and only through experimentation, trying this and trying that, can I finally obtain a satisfactory result.

I am not going to state flatly that there is more artistry and creativeness in the printing than there is in the original picture-taking, for I believe that they enter into both processes. However, poor picture results can be obtained from a well-taken negative just as surely as skillful printing can often salvage a not-too-good film.

Not all portions of a negative are equally good. Some parts tell an interesting picture-story, some do not. Some parts of a negative may be clear and in focus, other parts may be blurred and useless. And that is where selection and printing are of vital importance.

All of us have negatives with good portions and bad portions in them. Frequently we file these away — regretfully, perhaps — wishing that the good parts could be cut out and saved and the bad parts forgotten. By printing them properly, we can do exactly that.

I ran across a negative of this sort not long ago. In fact, I found it as the result of that negative-file housecleaning that I wrote about last month. I had completely forgotten about it. Then, when I saw it again, I put it under the enlarger and tried some experiments. Only two of the results are shown here — the original complete negative and the final selection of what I consider the best detail from it. But by referring to the original picture, you can see the other possibilities as I discuss them.

This is a print of the complete negative, showing the blurred and unusable portions, as well as the parts that tell a story in themselves and are clear enough to be used as an independent picture.

The original exposure was made on a market day in Oaxaca, away down in southern Mexico. At that time Oaxaca was the last town one could reach by automobile on the road that was eventually to lead to the border of Guatemala. Maybe it is still the last town — as to that I do not know. Saturday is market day. The Oaxaca market is famous for its cutlery, everything from dainty little knives suitable for use as letter-openers to wicked looking blades with which one hombre could slice another hombre neatly in two. There are also beautiful pottery, textile, and leather goods to tempt the buyer, as well as eatable and usable items of every imaginable description. People travel many miles to market — some of them walk all night or even longer because market day is not only a time to buy or sell, it is also a time to visit, gossip, have fun, see the sights, and maybe even get happily *borracho* on tequilla, mescal, pulque, or any of the other heady liquids to be found in the busy *cantinas*. People even come from the far-off Isthmus of Tehuantapec — Tehuanas in their gaily colored dresses and Tehuanos in their strange looking sugar-loaf shaped hats. The Oaxaca market is a gay and colorful affair, just the sort of thing to tempt a roving photographer.

Enlarged detail of the larger and partly blurred picture. Note how the center of interest, the face, is above center, and the eyes have enough space in which to look before they reach the edge of the picture.

But handling a 4 x 5 Graflex in such a throng was no simple task. (Alas, that was long before the advent of my much more manageable Kine Exakta.) The Graflex is a big camera and using it takes a lot of room. Adjustment of focus, exposure, and the like take time. Besides all that, there is nothing secret about a Graflex. You cannot hide it and when you point it at a person, he knows he is being aimed at — that is, unless somebody walks in front of you just as you release the shutter.

A group of women selling food items under a ragged awning along the sidewalk interested me. I tried for a shot of them. There were numerous results, as you can tell from the complete picture. Somebody stuck a shoulder into the lower right of the picture, blurring that part very nicely. Something else blurred a part of the center bottom. Farther back, but still too close to the camera to be

properly in focus, a girl strolled into the scene. The background was a confused mass of detail.

From the whole I got three distinct faces — distinct insofar as they are clear and in focus. The one on the extreme right fairly begs for more pictures but, alas, that opportunity vanished long ago. As she is, there is not enough of the woman visible to make a good or a clear individual picture.

The woman in the center seems greatly interested in the food she is preparing for a customer completely obscured by the girl who walked into the picture. A photograph of the sale would have been good if uninterrupted. As it is, the seller does not have enough setting to tell a complete story.

The woman on the left really is the picture. She had no idea that the camera was pointing at her. Her eyes and her thoughts are both focused far away. Her hands rest idly on the basket of tortillas, her *rebosa* is draped gracefully around her shoulders, and there is a cloth of some sort braided into her dark hair. I wish I could remember what color that cloth was but the memory is gone and the black-and-white film gives no hint of it.

As a part of the confused scene, she is interesting but not particularly arresting. The whole picture, as I say, is useless. But placed in an enlarger and made into a picture of her own, the tortilla seller becomes a distinct individual. Blurred though the background is, she stands out against it. The picture is cropped about midway down her long basket. I think it has better balance that way. Now there are no extraneous details to detract from her face. One can study those unseeing eyes, the partly open mouth, the high cheek bones, the expressionless yet expressionful face, the distinctive headdress, for minutes at a time. What was she thinking and what was she seeing, that nameless tortilla seller in the Oaxaca market?

There is scarcely a negative exposed that is equally good in its entirety. Some portion of it can be cropped out or omitted, or its proportions can be changed, ever so slightly. And, since we are all individuals, each of us has his own individual ideas as to how and where those omissions or those changes should be made. And in cases like that, no one else can do the job to suit us. So, as old Ben Franklin once advised, if you want the picture printed right, get an enlarger and do it yourself.

Just what is the secret of composition, which I have mentioned so often as being of vital importance? It is hard to explain although its presence or absence plays a vital role in the artistic effect of a picture. Words like balance, harmony, definition, symmetry, tone, center of interest, and pleasing repetition, are apt to enter into the conversation when people discuss it.

Good composition cannot be mapped exactly or plotted with compass and slide rule. For that matter, no two people may agree as to what is the best composition. In the long run, it is an individual sort of thing, and if the photographer pleases himself (unless, of course, he is striving for a prize in some sort of picture competition) his own satisfaction is all that is necessary.

The new Fedco twin surface enlarger is large enough to accommodate four 8 x 10 prints.

There are a few basic principles of composition that should be borne in mind. Among them are:

1. Do not place your principal subject in the mathematical center of the picture. (In my Oaxaca woman's picture the face is above the center).

2. The horizon should be above or below the center, above if ground items are more important and below if cloud formations are being emphasized.

3. Dominant lines should be relieved by secondary lines running in the opposite direction; this relieves the monotony of too many parallels.

4. Lights and shadows, as well as lines, need to be balanced and correct balance of light and shade unifies a picture.

5. There should be one main center of interest, something the eye and the brain can focus on.

6. If the main subject is far away, items of interest should be used to relieve the monotony of the foreground. These should not, however, be in any way rivals of the main subject in importance or interest.

7. If the subject is looking off into space, give him room in which to look. (While centered, the Oaxaca woman's eyes have sufficient staring space. More might have been given by cropping the picture closer at the left.)

And so, in summary, watch for those portions of negatives that tell a story of their own. Learn darkroom techniques and the use of an enlarger, if you have not already done so. You will be pleasantly surprised at how right Benjamin Franklin was when he advised that if we want something done right, we will do it ourselves.

MISCELLANEOUS ITEMS

While we are on the subject of darkrooms and darkroom techniques, here are some items of interest.

Eastman has two new data books available. The one on "Darkroom Construction" is designed particularly for professional and industrial use. However, the amateur who is planning to build his own will find some interesting pointers as to materials, construction, and arrangement. The other, on "Chemical Preparations," gives basic information on nearly 50 Kodak preparations for the processing and after-treatment of films, plates, and papers used in black-and-white photography.

Du Pont has added a new surface, DS, to the line of Varigam variable contrast photographic paper. This makes a total of ten varigam surfaces available. The new DS is listed as a velvet grain, natural white, high luster, double weight paper, usable for portraits and pictorial subjects of all kinds.

Eastman also recently issued a new line of enlarging paper, the Kodak Medalist line. This comes in four different contrasts and the combination is designed to give rich, warm-black image tones, wide exposure and development latitude, and permits the use of any of the standard toners.

Finally, after the prints are made, Fedco Products, Inc., has added a new model No. 250 twin surface dryer, usable for contact prints, enlargements, photostats, and blueprints. The dryer can accommodate four 8 x 10 prints on its twin 11½ x 17½ surfaces. The unit can be used with either AC or DC current, each surface takes only 125 watts, and the price is $17.95, tax included. For more information contact Fedco at 37 Murray Street, New York, and be sure to mention "Camera Trails."

The one-minute Polaroid camera has been put to work helping to fight forest fires, according to a report from the manufacturer, who quotes senior foresters at Sequoia National Forest. Fire spotters in a plane photograph tell-tale wisps of smoke and drop the pictures, together with vital statistics about the blaze, to fire fighters on the ground. This helps fire bosses to direct their crews in saving valuable timber from the flames.

British Nature Books

Pond Life. R. L. E. Ford. 96 pages. Illustrated in color and black and white. *The Naturalist on the Seashore.* By E. M. Stephenson. 96 pages. Illustrated in color and black and white. *British Trees.* By C. A. Hall and B. A. Jay. 96 pages. Illustrated in color and black and white. *British Fossils.* By Duncan Forbes. 96 pages. Illustrated. New York. 1952. The Macmillan Company. $1.35 each.

This group of books all have descriptive titles and are simple introductions to the fields of Nature in Great Britain indicated in those titles. The text is popularly handled and the intent is, apparently, to interest the casual reader to such an extent that he will be interested in going on to more advanced texts.

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THE BIRDS

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FERNS HERE AND THERE

(Continued from page 152)

and rain, heat and cold, and when I last saw it, at a time when there had been little or no rain for almost two years, its rich appearance proved that the roots must be drawing moisture enough from the basement of that rock to enable it to carry on.

The surfaces of ferns of the coastal redwood region are bare and smooth, their roots living not in gravel but in the lush deep humus of leafmold or rotted wood. Here fallen logs have hardly begun to decay when they are peopled by seedlings of redwood, Douglas spruce, maple, salal, blueberry, azalea and ferns. On one short log I have counted thirty-eight different kinds of plants. In this humid land of half light, where brown millipedes glide over spongy moss and the sweet song of the thrush comes from dark places, leatherleaf fern, a polypody, may monopolize the whole length of a fallen tree trunk. On other logs the taller, narrower fronds of deer fern join young hemlocks, and both rise from a groundwork of oxalis and yellow violet streamers. Deer-ferns may take to climbing live standing trees and get several feet up the trunk. Along the base of the log grow giant chain-ferns, lady-ferns and holly-ferns, and close by, in a place less densely inhabited, a colony of five-finger is so satisfied with its home that some of its fronds measure twenty-seven inches across. This place of slanting light, roofed with high tree branches, where orange and red toadstools appear and swiftly disappear, and dense white mists roll in from the ocean, is a far cry from exposed mountain crag and arid desert, but ferns, like people, have their own ideas on how and where they want to live.

THANKS TO A BEAUTY-LOVING MOTHER

(Continued from page 155)

she rocked her child to sleep, that Quaker mother would recite great poems, and the more beautiful of the psalms, to her child. And before the little one could walk she was taught to observe the birds, to listen to their songs and to watch their flight; to smell the flowers and handle them carefully, and to watch the sunsets.

To that "beauty-loving mother" we should give thanks to a world-wide movement in Nature-Study that her daughter, trained to observance and understanding and appreciation of beauty, passed on to a beauty-hungry world. Besides being scientifically accurate, her approach was also esthetic and philosophical.

From this there can be a simple transition to teaching children that there can also be beauty in action, in living, in the friendly gesture, the honest answer, the generous act, the unselfish sharing of what he has.

All this a "beauty-loving mother" can bequeath to her child.

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SPHAGNUM MOSS GOES MODERN

(Continued from page 148)

when needed. Sphagnum itself gives no nourishment. If you wish to stimulate growth, add nutrient solution — for example, five teaspoonfuls of 5-8-6 garden fertilizer per gallon of water. To check growth, do not add it. Some plants have been kept in a state of arrested development for a year by simply feeding them water. In ordinary use — transplanting seedlings after their first true leaves appear — one application of nutrient is recommended, but not necessary. Easy-going sphagnum allows you to make your own rules.

Among plants that have been "stored" for a year were seedlings of the cinchona tree. This is the strategic tree from whose bark quinine is produced. Sphagnum's role here is that of an unsung hero of the last war. In Caribbean regions, growers of cinchona had been reluctant to believe that the plants grown in sphagnum would be as dependable as those started in soil. This was the belief, despite the fact that half the plants grown in soil died in the voyage by sea to Caribbean points.

Wartime need for more cinchona plantations and quinine overcame the prejudice. Plants grown in sphagnum were packed with much of the moss still clinging to their roots. They were larger than plants grown formerly, but their shipping weight per plant was only one-seventh that of plants grown in soil. Packing costs in time and labor were greatly reduced, and the plants were shipped in pasteboard cartons rather than wooden cases. All this meant they could go by plane. Results were dramatic. In one lot of 90,000 plants, less than two percent died. The rest were transplanted to soil and became a sturdy plantation.

Unlike the proverbial rolling stone, onward moving science has gathered some moss, and made highly modern use of this ancient among plants.

THE CHERRYSTONE JUNIPER

(Continued from page 126)

bunch of rabbitweed or snakeweed. Prayer sticks, war bows, and bows for the canopy of the papoose cradle are made by the Navajo of the wood of this tree, and they use it as charcoal for smelting their famous silver jewelry.

The wood is close-ringed, and, in consequence, hard and dense. Like that of most junipers, it is, if properly seasoned, strongly resistant to decay, and is used locally for ranch fence posts, although there is never enough clear lumber to make boards of it. A pity, since it has a delicious cedar-like fragrance, and handsomely contrasting ruddy heartwood and clear pale sapwood.

The female trees are sought for their berries by the Hopi chipmunk, quail, fox, rock-squirrel, and deer. Both sexes yield browse to New Mexico's omnivorous goats — but what does not?

ANIMAL FRIENDS, DEPENDENT AND FREE

(Continued from page 136)

gether individuals and groups, which, if they could obey their instincts, would drift apart; we tear families asunder with no consideration for parental and social bonds. No wonder our domestic animals so often fight, and misbehave, and mismate, and act in a manner to try our patience and disgust us. Under equivalent circumstances, our own conduct would probably be even more disorderly.

If the relations of our domestic animals among themselves leave much to be desired, their relations with their masters are hardly more felicitous. They have not been associated with us for the requisite number of generations, or under conditions sufficiently uniform, for the necessary adjustments to become innate. They too often fail to understand our desire for cleanness, for quiet and repose, for promptness in the execution of tasks and journeys, for preserving from all depredations the plants we sow. Of all our domestic animals, the dog is most understanding of our moods and responsive to our will. But the relation of the dog to its owner is that of slave and master, not of two beings who can respect each other as equals. The dog is cringing and subservient as no other domestic animal I know. He is a sychophant, who wagged his way into acceptance by primitive man and holds his place by playing with infinite finesse upon the vanity of his civilized descendants. This has won for our canine friend the exaggerated panegyrics of Maeterlinck and others who are not displeased to imagine that they are looked upon as "gods." As though we needed the encouragement of lambent tongue and swinging tail to fortify our flagging egotism! If we wish the testimony of the animal kingdom as to our godlike nature, let us be impartial and take it all together. Do these free creatures running and hopping and creeping and flying in a frenzy to escape as we pass through their haunts regard us as benevolent gods or as frightful devils?

One reason for this almost universal fear of man is his association with the dog. With him we pass through meadow and woodland like a fire-engine through a sleepy town, shattering every creature's repose, causing each alarmed citizen of the uncultivated places to scurry in one direction or another in a mad effort to escape this most devastating combination of keen nose, sharp eyes, admonitory bark, and incomprehensible power to strike at a distance. The dog makes it more difficult for us to cultivate harmonious relations with free animals, and his subservience foments our already egregious human pride. I doubt that this is a relationship to be encouraged.

Although it has been my experience that contacts with free creatures are more enlightening and satisfying than association with dependent animals, I shall not go so far as to suggest that children be denied pets. These have often been stepping-stones to a wider intimacy with the living world. But I believe that pets should be few in number, and of kinds that have been so long domesticated that their needs are well understood and can be satisfied, rather than recent captives from the wild which too often languish and die. If the child is permitted to keep his pet only so long as he attends it faithfully, his ownership may promote his sense of duty, of benevolence, and of responsibility to dependents. His animal friend may be used to train his powers of observation, and for early exercises in keeping records. But as soon as possible he should be helped to find satisfaction and delight in creatures as free as himself and subject to no man's will. To the seeing eye and the understanding mind, the commonest animal that in garden or dooryard leads its free, untramelled life according to its ancestral pattern, can teach more, and more generously reward our patience, than some rare, strange creature that has been torn from its natural setting and subjected to our pleasure.

As to farm animals, I believe that economic prudence no less than humanitarian feeling must with the passage of the years lead us to keep fewer and fewer. Since animals are not primary producers but merely transformers of foodstuffs, there is tremendous loss of potential human food in rearing them in order to use their products. A hundred acres will support far more men if planted to grains, fruits, and vegetables than if devoted to livestock; and wherever populations have become dense, the consumption of animal products has perforce diminished. As we learn to take full advantage of the great variety of proteins which the vegetable kingdom provides directly, there is less inclination to resort to animal flesh in order to balance our diet. With the more intensive production of foodstuffs made possible by improvements in agriculture and the elimination of livestock from the farms, we should be able — the human population remaining the same — greatly to reduce the area of cultivated land. The less fertile lands retired from cultivation would be allowed to revert to wilderness and serve for recreation, for the sustained production of much-needed timber, and as a home for free animals. Here they would be allowed to work out their own destinies. Too long have they been enslaved, driven about, mutilated, and made to serve another's end. It will be better for us no less than for them when we cease to impose our will upon them.

SIGNS OF SPRING IN THE SKY

(Continued from page 157)

period of perpetual daylight at the north pole. This will be followed by the six months period of continuous night, which has just ended at the south pole, where the long polar day will start as the sun reaches the autumnal equinox of the northern hemisphere.

In the north temperate zone the position of the celestial equator is fixed when the latitude of the place is known. As the sun remains practically in the equator with only a small northward motion in declination for 24 hours one may trace its path across the sky from the east point to the west point on the day when spring begins, and also when autumn begins. It can be shown that the distance above the south point on the horizon at which the equator crosses the meridian in the north temperate zone is equal to 90 degrees minus the latitude of the place. So it is 90 degrees at the earth's equator, 0 degrees at the north pole, and 90 minus 40, or 50 degrees, in 40 degrees north latitude. In the north temperate zone it will always pass south of the zenith, therefore, and in the south temperate zone it will always pass north of the zenith.

As spring advances the distance of the sun north of the celestial equator gradually increases until, at the summer solstice in June, it is 23½ degrees north of the celestial equator, or 50 degrees plus 23½ degrees above the southern horizon in latitude 40 north. This is the highest point in the northern heavens that the sun reaches in that latitude. The lowest elevation above the horizon which the sun will have will be 50 degrees minus 23½ degrees. This will be at the time of the winter solstice in December.

It will be interesting to note this month the change in position of the points of rising and setting of the sun on the horizon between March 1, when the sun is about 8 degrees south of the equator and so rises south of east and sets south of west, and March 31, when it is about 4 degrees north of the equator and so rises north of east and sets north of west. One may note also how sharply the ecliptic rises north of the equator from the western horizon at sunset near the end of March, and search for Mercury near its time of greatest eastern elongation on March 18. This is also the best time to observe, if possible, the phenomenon of the zodiacal light in the western evening sky along the ecliptic after sunset.

Venus is still a fine Morning Star. It is now in the part of its orbit between greatest western elongation and superior conjunction with the sun, when it shows the gibbous phase in the telescope. It will be in the southeastern sky in March before sunrise. Mars will be found on March 1 very near the third magnitude star, Alpha Librae, in the constellation of Libra, and moves eastward only a few degrees up to March 24, when it is stationary in position. After that date it moves slowly westward, or retrogrades, the remainder of the month. Mars now rises before midnight in the southeast and increases rapidly in brightness during the month until it surpasses Vega or Capella in brightness. Jupiter is in Pisces this month in the western evening sky and is a brilliant object. It is at this time almost exactly equal to Sirius in brightness. Saturn is now in Virgo to the northwest of Spica and is visible nearly all night as opposition occurs on April 1. It is moving westward through the heavens at this time or retrograding in its orbit.

Guide to the Heavens

Stars. By Herbert S. Zim and Robert H. Baker. New York. 1951. Simon and Schuster. 157 pages. Illustrated by 150 paintings in color by James Gordon Irving. $1.00.

This latest addition to the series of Golden Nature Guides is a guide to the constellations, sun, moon, planets and other features of the heavens. It is a book for the novice and the amateur, and the best dollar's worth ever produced, so far as we know, in the astronomy field. Introductory pages are devoted to basic information about seeing the heavens, and then the sun, sunlight, rainbows, sunspots, northern lights, sunrise and sunset, the telescope, the stars and other heavenly bodies are discussed briefly and in popular terms. Sky maps are included and detailed maps of the constellations. The planets are included, of course. An excellent guide.

Western Amphibia

Amphibians of Western North America. By Robert C. Stebbins. Berkeley and Los Angeles. 1952. University of California Press. 539 pages. Illustrated. $7.50.

All known species and subspecies of amphibians found in western North America are included in this important work. The area covered is bounded on the south by the border of Mexico, on the east by the eastern boundaries of New Mexico, Colorado, Wyoming, Montana, and by Saskatchewan and Mackenzie, Canada. Distribution, habitat, structural and color characteristics, behavior, food habits, and reproduction are all included in the discussion of each amphibian. An excellent bibliography and index are provided.

Earthworms

Raising Hybrid Earthworms for Profit. By Earl B. Shields. Chicago. 1952. 107 West Wacker Drive. 51 pages, plus listing of other hobby booklets. $1.00.

The title of this booklet is descriptive of its contents, and it is a practical discussion of the tricks of raising earthworms and promoting the sale of the product.

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PHILADELPHIA MEETING

By HELEN B. ROSS

GETTING into high gear with the opening session on Thursday, December 27, the joint and individual sessions of ANSS, NABT and NSTA continued at full speed through the three days of sessions and the Sunday field trip to the New Jersey pine barrens. One reason for this fast start was the joint session at which lovely Dr. Rose Lammel of New York University presented some provocative ideas on the manner in which the science curriculum is — and is not — meeting the needs of children. The audience then broke up into discussion groups, then coalesced again for an active period of questioning, terminated only by hunger for luncheon.

The first afternoon session of the American Nature Study Society was under the direction of past-president Charles Mohr and featured E. Laurence Palmer and vice-president-elect Ruth Hopson. "Survival Training" was the title of Dr. Palmer's paper, putting a practical note into outdoor activities. It also made the listeners feel as though it might be fun to be abandoned far from "civilization," particularly if one were equipped with the know-how of the sage of Ithaca. With a splendid motion picture of Oregon, and what to see and do there, Dr. Hopson indicated that the charms of that State are such that Dr. Palmer's advice might well be put into practice out there.

Immediately following this session the annual meeting of ANSS was held, retiring president Ellsworth Jaeger presiding. Result of the balloting for officers was announced, showing Roger Tory Peterson as President; Ruth E. Hopson, Vice-president; Helen B. Ross, Secretary; Gilbert Mouser, Treasurer. Directors elected for 1952 were William G. Vinal, H. Raymond Gregg, Theodore Eckert, Seymour Fowler and Dorothy Miller Matala. C. Kent Warner was named chairman of the membership committee, and Malvina Trussell, Florida State University, Tallahassee, offered herself as a sacrifice as editor of the *News Letter*.

A new departure in the way of a special evening proved a huge success. A good and reasonably priced buffet supper was followed by a showing of slides by Jim Fowler, Thomas Knapp, Raymond Keinholz, Ellen Bonwill, Leo Blackman, Lloyd Heidgerd, Leo Hadsall and Charles Mohr. Then all adjourned to the roof garden for an all-societies mixer, which featured strenuous square dancing, more sedate social dancing and a bubbling but quite innocuous punch bowl.

Our Society had charge of the joint session on Friday morning, past-president Dick Westwood presiding. Speakers dealt with science instruction in meeting community needs. Theodore Eckert presented the teaching picture and a condensation of his discussion will, in due course, appear in *Nature Magazine*. Florence Weaver presented an inspiring paper on democratic use of the group-unit method of teaching, a paper that merited more time for discussion than was available. Raymond Keinholz described, pictorially and verbally, the accomplishments of the conservation caravan of the University of Connecticut and its cross-country trek. Ellsworth Jaeger showed a splendid motion picture of the work of the "Tepee Camporee," an effective summer activity of the Buffalo Museum of Science. The session concluded with a fine motion picture with sound, "Tar Heel Family," emphasizing the resource-use program of North Carolina, with Dick Weaver providing background information.

With Edwin Way Teale his usual urbane self as presiding officer, an evening session on Friday took those in attendance behind the scenes to reveal secrets of writing for, editing and publishing nature magazine. John K. Terres, managing editor of *Audubon Magazine*; Richard W. Westwood, editor of *Nature Magazine*, and Edward M. Weyer, Jr., editor of *Natural History*, set the stage for a lively period of questioning with informal discussion of the problems involved. The three editors later agreed that they got fully as much out of the session as did the audience.

At the Saturday session the presiding officer of a panel on the use of audio-visual aids was W. Hughes Barnes. Contributing to the information derived from this discussion were Warren P. Everote, specialist in nature and science teaching films for Encyclopedia Britannica Films; Ida K. Langman of the Philadelphia Academy of Natural Sciences, and Booker T. Washington, principal of the Williston Industrial School, Wilmington, North Carolina.

ANSS field-trippers being a hardy lot, they were undaunted by a drizzling rain and set out with their box lunches for an exploration of the New Jersey pine barrens and a peek at the Atlantic Coast. Leaders were Joseph M. Cadbury, James A. Fowler, Louis E. Hand, E. Laurence Palmer, Roger Tory Peterson and Edgar T. Wherry. Thus a wide range of subjects was thoroughly covered and the trippers found the day well spent.

Before the 1951 session broke up the planning committee met to provide a preliminary outline for the meetings of 1952, which will be held in St. Louis.

Bulletins Received

"Food Shortages and the Sea" by Daniel Merriam. A discussion of the possibilities of the sea in meeting food problems. Publication 4039, Smithsonian Institution, Washington, D. C. . . "Natural History in Iceland" by Julian Huxley. Some interesting experience of a naturalist in Iceland. Publication 4036, Smithsonian Institution, Washington, D. C. . . "Praying Mantids of the United States: Native and Introduced" by Ashley B. Gurney. Publication 4037, Smithsonian Institution, Washington, D. C. . . . "Economic Uses of Lichens" by George A. Llano. Publication 4040, Smithsonian Institution, Washington, D. C. . . "Man's Disorder of Nature's Design in the Great Plains" by F. W. Albertson. Publication 4038, Smithsonian Institution, Washington, D. C. . . "The Timber Supply Outlook in South Carolina" by Robert W. Larson. Superintendent of Documents, Washington 25, D. C. 65 cents. . . "Mississippi's Forest Resources and Industries" by Lee M. James, Superintendent of Documents, Washington 25, D. C. 50 cents. . . "Australian Wildflowers" and "Australian Birds and Animals." Largely pictorial booklets available on request from Australian News and Information Bureau, 636 Fifth Avenue, New York 20, New York. . . "The Museum," Vol. III, No. 3, is devoted to a discussion of New Jersey minerals by Harold R. Magnuson. Published by The Newark Museum Association, 43 Washington St., Newark 1, N. J. . . "Eton College Natural History Society, 1939-50." The first report of the Society since 1938. Two shillings, sixpence.

Briefly Listed

The Battle for Mental Health. By James Clark Moloney. New York. 1951. Philosophical Library. 105 pages. $3.50.

A popularly written discussion by an eminent psychoanalyst of the importance of prevention of mental illness.

Elias E. Ries, Inventor. By Estelle H. Ries. New York. 1951. Philosophical Library. 369 pages. $4.75.

A biography of a pioneer in the field of electrical development and invention, written by the daughter of the subject.

North of the Circle. By Frank Illingworth. New York. 1951. Philosophical Library. 254 pages. Illustrated. $4.75.

The story of people and life, adventure and animals north of the Arctic Circle.

A History of the Theories of Aether and Electricity. By Sir Edmund Whittaker. New York. 1951. Philosophical Library. 434 pages. $12.00.

A discussion of the classical theories, to be followed by a second volume bringing the discussion down to date.

The Butterflies of Virginia. By Austin H. Clark and Leila F. Clark. Washington, D. C. 1951. The Smithsonian Institution. 239 pages. 31 plates.

Scientific discussion of Virginia butterflies, of particular value to serious students of lepidoptera.

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A place where members of the American Nature Association and readers of Nature Magazine may find many interesting offerings or may advertise themselves, at low cost, for things wanted, things they have for Sale, for Trade, for Sale or Trade. This is an excellent forum for acquiring or disposing of such items as binoculars, books, cameras and photographic equipment, magazines, sports and outdoor equipment, etc.

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By JULIAN D. CORRINGTON

BIOCENTENNIALS

Leonardo da Vinci (1452-1519)

"The Medici created and destroyed me."

IN THE year when Columbus discovered America, if the average literate European had been asked to name the most famous man in the world, he probably would have nominated Leonardo da Vinci, the great universal genius of Florence, one of the small city-states antecedent to modern Italy. At this time a weakened feudalism still reigned; the Moors had just been driven out of Spain by Ferdinand and Isabella; Bosworth Field had ended the War of the Roses, and a Tudor, Henry VII, sat the English throne, while James IV ruled Scotland; Charles VIII of France had just married Anne of Brittany, gaining that Duchy for the French. But in what is now Italy there were a dozen petty states, constantly embroiled in bickerings between great houses — the Sforzas, the Medici, the Borgias. When not invading each other, these tiny, semi-independent governments — Milan, Bologna, Florence, Genoa, and others, with the larger and more powerful Venice and Naples — were continually serving as battleground for Spain, France, and Germany.

Great events were about to transpire in Western civilization; voyages of discovery, the Reformation and, within a hundred years of Leonardo's infancy, the overthrow of authority in science and rebirth of the spirit of investigation. In retrospect, the famous Florentine stands poised, at the head of the avalanche of the modern in the arts, literature, and science.

Genetically, Leonardo is as much a mystery as Shakespeare or Lincoln. Born out of wedlock, he was the son of a notary, Ser Piero, and a peasant maid, Catarina. His father belonged to a family of lawyers, decidedly a better pedigree than the average, but with no particular gifts in the line that would point to a supergenius. Yet the son possessed in an extraordinary degree enough skills for a dozen men and, in the opinion of many, was probably the most accomplished person who ever lived. In his own day and down through the centuries he has been so acclaimed, and this all the more surprising in view of the fact that he left behind so few finished productions.

Vinci was a small, fortified, hill village near Empoli, in the Florentine state, from which the family took its name, but the legal practice was in Florence, and it was in the city that the young Leonardo grew up and received his training in the arts of music, drawing, and modeling. Exhibiting remarkable proficiency, he was apprenticed to the renowned sculptor and painter, Andrea del Verrocchio, for some seven years. It is related that the youth was given the assignment of painting an angel in the master's *Baptism* and that this figure turned out to be much better than anything Verrocchio himself could execute. The story calls attention to a custom then prevalent; a master had about him a number of apprentices and assistants and would turn out work like a modern assembly plant. After roughing out the main features of a proposed or commissioned painting, the master would occupy his time otherwise while apprentices worked up most of the canvas, one putting in a background, another specializing in draperies, a third in figures. The master would then add his special touches to the nearly finished product. The amount of help he thus received varied a great deal, according to his wont, but gave the younger men needed experience and speeded up the output. This practice explains some of the questions concerning authenticity of Leonardo's work, when later he managed his own studio in the same manner.

By 1472 Leonardo was a full-fledged member of the painter's guild and had become the friend of Botticelli and Perugino. In 1477 he left Verrocchio and started work as an independent artist, under the patronage of Lorenzo the Magnificent, Prince of the House of Medici, and himself a poet and scholar. Commissions followed, but for the most part remained unaccepted or unfinished. For the young man, who was soon celebrated for his great personal charm and wit, had developed a passion and an aptitude for all knowledge, and was busy studying and exploring in all fields at once, an occupa-

Mona Lisa by Leonardo Da Vinci

tion not conducive to the completion of any one line of work. The painter who could depict the human face or folded costume with an art never before seen, and who could play the lute entrancingly, and was beginning to be a sculptor of note, was now led into the many lanes of science.

A description of the young artist was given by the unknown writer called the Anonino Gaddiano: "He had a fine figure and was well-proportioned, graceful and of handsome appearance. He used to wear a short pink cloak, reaching to his knees, when long garments were the fashion of the day. He wore his beard long, curled and beautifully kept, falling down to the middle of his chest."

In order to create a picture of a dragon, he investigated the structure of a considerable number of mammals, birds, reptiles, and insects, taking a part from this one, another part from that one, and assembling them into a frightening composite. Unsatisfied with paintings having no background, or those with faulty relationships of objects, he took up geometry and applied this study to perspective in art, being led thence into mathematics for its own sake. Wrote one critic: "He is entirely wrapped up in geometry and has no patience for painting." That he might represent the human figure more precisely in both drawing and modeling, he delved into human anatomy, then equine anatomy for his horses, while, to represent correctly a bird in flight, he successively explored the subjects of meteorology and bird anatomy, finding that to understand the movements of air as wind, he must first assay the movements of water as waves. Each study opened new vistas, and his mistake lay in attempting to follow every lane, not knowing when or where to stop. Being frequently called upon to assist at pageants and court shows, he became famous for the creation of automatons. One oft-cited example was his automatic lion, that walked forward a few steps, then stopped and opened its chest, disclosing a cavity full of lilies. This sort of thing developed Leonardo in mechanics and led to his application of machines to the art of war, while the combination of all these skills aided in making him the foremost architect and engineer of his day.

By the time Leonardo left Florence for the court of Ludovico Sforza (Il Moro), Duke of Milan, about 1483, when in the neighborhood of 31 years of age, he could do anything — feats of strength and horsemanship, excel in conversation, and all the then known arts and skills. He was naturally much sought, yet he not only never married, but there are no recorded great love affairs in the life of this brilliant man. Some quotations will attest his literary powers and worth as a philosopher:

"That venerable snail, the sun."

"Feathers shall raise men even as they do birds, towards Heaven; that is by letters written with their quills."

"Man has great power of speech but the greater part thereof is empty and deceitful. The animals have little but that little is useful and true, and better is a small and certain thing than a great falsehood."

At Milan Leonardo was to create an equestrian monument to the founder of the House of Sforza, Francesco Sforza, and he therefore went into equine anatomy and the art of casting in bronze on a heroic scale. With the passing years we find him participating in architectural plans for strengthening and beautifying the ducal castle and completing the Milan cathedral, directing the court pageantry at the occasion of each important marriage or other major event, designing a bathing pavillion of entrancing beauty, filling notebooks with studies in statics and dynamics (the physics of that time), or human anatomy, and studying mathematics with the scholars of Pavia, whither he went as a consultant for work on the cathedral. But it was not until 1493 that the finished model for the Sforza statue, 26 feet in height, was completed and put on display in the courtyard.

About 1474 the celebrated *Annunciation* (Uffizi, Florence) was finished, and there has been much argument today as to its authorship, some critics asserting that it undoubtedly is a Leonardo, others ascribing most of its execution to different artists. With his assistants, the two versions of the *Madonna of the Rocks* (Louvre and National Gallery, London) were done between 1483 and 1508. To the period 1481-82 belongs the *Adoration of the Kings* (Uffizi), while the *Virgin and Child with St. Anne* (Louvre) was worked on around 1506-10. The latter is a composite and both are unfinished.

In 1494 the fabulous Florentine received his commission for and began work on his greatest painting, the *Last Supper* (*Cenacolo*), a mural for the refectory of the convent church of Santa Maria delle Grazie at Milan, and this time the work was attacked with such zeal and perseverance that it was finished in four years, though there were all manner of interruptions. In spite of ravages due to faulty preparation of surface and materials, unfavorable climatic conditions, vandalism, neglect, and inferior methods of repair, so that at last a mere shadow of the original remains, it is nevertheless, in the opinion of many, the world's most celebrated painting. Recent restorations have been more scientifically and expertly performed, and in 1951, Winter and assistants recreated the original in the United States, to serve posterity when the masterpiece shall have vanished. Many famous articles and even volumes have been written about this great painting, from Goethe's criticism to D'Annunzio's *Death of a Masterpiece*.

After sixteen years at Milan, Leonardo left in 1499, journeying to Mantua and Venice, then back to Florence. Following the great success of his *Last Supper*, he was continually besieged to paint portraits

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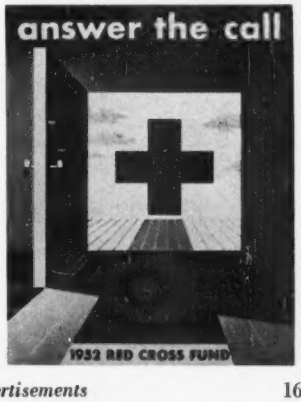


of the great and the near-great, to execute altar pieces and religious paintings and various sculptures. Many commissions he refused; some he accepted but never completed. The *Portrait of Ginevra de' Benci* (*The Lady of the Juniper*; Vienna), was done in 1501, according to Colvin, although put as early as 1474-78 by Goldscheider, who calls its Leonardo's most beautiful female portrait, while to others the authorship is questionable.

The world's most famous portrait and most popular painting is beyond doubt the *Mona Lisa* (*La Gioconda*), 1503, portrait of Lisa Gherardini, the wife of Francesco di Zanobi del Giocondo. Stolen from the Louvre in 1911, it was recovered two years later. We were in Paris at the time and shall never forget the tremendous excitement and the vast crowds that thronged the Louvre after this restitution. People of every walk of life, many who had never set foot in the vast art gallery before, came to see and to welcome home *La Joconde*. This is the sole extant portrait by the great master the authenticity of which has never been disputed. Leonardo sold it to Francis I, King of France, for 12,000 francs. The preservation is unsatisfactory, with varnishings and overpaintings. Leonardo's mastery is of light and shade rather than color, and he customarily used dark grounds for his canvases; the ground has come through the portrait, making the whole too somber. In spite, however, of this dimmed and darkened condition, *Mona Lisa* continues to fascinate all beholders with her enigmatic smile.

Leonardo took service as chief engineer with Caesar Borgia in 1502-3, revisited Milan in 1506, but was frequently called back to Florence because of litigation over his father's estate. A two-year stay in Rome was his least successful venture, the atmosphere there being somewhat hostile owing to the jealousies of the younger Michelangelo and Raphael. He died in 1519, aged 67, at the Castle of Cloux, near Amboise, France, a residence that had been assigned to him, along with a liberal pension, by the king.

His great plans to complete the *Battle of the Standard* (*Battle of Anghiari*), which was to have served his native Florence as the *Last Supper* for Milan, as a masterpiece to attract worldwide acclaim, were never finished. Many sketches remain, notably at Windsor Castle and at Venice. Likewise his projected Sforza monument was never cast, and the model, lauded by all contemporary accounts as supreme in magnificence, was shot at by archers when the French occupied Milan in 1499, and was later broken up and lost. We do not even know which of Leonardo's many sketches were selected for the final model.

Of drawings there remain today a great number, but of finished paintings only the *Last Supper* and *Mona Lisa*, both damaged, are universally accepted as solely the work of the master, while of his sculptures none remain. Thus the world's greatest artist (a commonly held opinion) has left, half a millenium after his birth, an insignificant amount of his many productions by which we may judge his stature. His failure to complete many of his assignments is the weakness in the character of this man, due to his absorbing interest in everything.

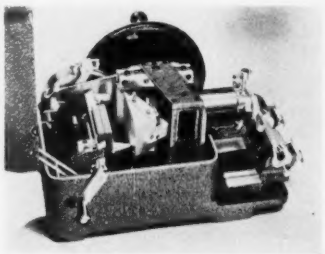
He was always on the verge of writing a *Treatise on Painting*, but probably never himself consummated the manuscript, the original being now lost or else represented only by scattered notes. An abridged version of 365 sections was published in Paris in 1551 by Raphael Dufresne from a manuscript he had found, and consists of brief paragraphs on criticism and instruction. An English translation appeared in London in 1877. In 1817 Manzi printed a larger edition of 912 sections at Rome, but only about one quarter of this material has been identified in Leonardo's many notes and some of it may represent the work of his students and of unknown compilers, using Vatican manuscripts, many of which are no longer in existence.

Leonardo worked up a Latin-Italian glossary and grammar for the young Sforza princes, then a *Beastiary* for their amusement, among the characters being a giant like that of *Gulliver*. Antonio de Beatis, secretary to the Cardinal of Aragon, kept a diary, and so set down some remarks about Leonardo's works on the occasion of a visit by the Cardinal at Amboise in 1517, just two years before the master's death. He comments on the manuscripts as forming "an infinite number of volumes," and mentions one in particular as titled *The Nature of Water*.

In our day a whole host of scholars have been at work digging out, collecting, compiling, arranging, editing, and publishing, in facsimile or as translations into various languages, an immense amount of material, known collectively as *The Notebooks of Leonardo da Vinci*, the history of which is very complex. The Florentine left his manuscripts, consisting of some 5000 sheets, to his executor, the devoted young friend and pupil, Francesco Melzi, who was with him at Amboise. But after Melzi's death in 1570, these priceless documents were dispersed all over Europe, some having been lost or destroyed in the years down to our century. The gathering of reproductions of these scattered sheets from Windsor, Paris, London, Milan, and other places so as to present them as a set of volumes to modern readers has been an immense task undertaken several times. In this country we are most familiar with Edward MacCurdy's definitive edition in two volumes (London, 1938), with an accompanying third volume containing the drawings, with introduction and notes by A. E. Popham (Reynal & Hitchcock, N. Y., 1945). The beautiful Phaidon (London, 1944) edition of the paintings and drawings, with notes by Ludwig Goldscheider, has placed incomparable reproductions within the reach of everyone. Collected sheets on certain subjects have been published as separate works, as the *Treatise on the Flight of Birds*, one volume on anatomy, and one on hydraulics.

From all of these it is now evident in our day the immensity of the scientific knowledge and attainments of this genius. In physics he discusses, draws, and often uses in his pageant automatons and war mechanisms all the simple machines, as the wheel and axle, pulley, levers, inclined plane, and such special examples as the balance, screw, and wedge. He understands momentum and acceleration, potential and kinetic energy, and denies perpetual motion, stating that it takes force to produce motion and that a thing in motion has force. "O speculators about perpetual motion, how many vain chimeras have you created in the like quest? Go and take your place with the seekers after gold."

(Concluded in April)



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